



7264

A  
TREATISE  
ON THE  
THEORY AND PRACTICE  
OF  
SEAMANSHIP:

CONTAINING  
GENERAL RULES FOR MANOEUVRING VESSELS,

WITH

A MOVEABLE FIGURE OF A SHIP,

So planned that the Sails, Rudder, and Hull may be made to perform the  
Manoeuvres according to the Rule laid down.

TO THE ABOVE IS ADDED

A Miscellaneous Chapter on the various Contrivances against  
Accidents,

AND A

SYSTEM OF NAVAL SIGNALS,

THE WHOLE FORMING

A useful Compendium to the OFFICER, to Instruct him when Young,  
and to Remind him when Old.

---

THE SECOND EDITION, CORRECTED AND ENLARGED.

---

BY

RICHARD HALL GOWER,

IN THE SERVICE OF THE HONOURABLE EAST INDIA COMPANY.

---

LONDON:

Printed for G. G. and J. ROBINSON, Paternoster Row.

---

1796.

A TREATISE  
ON THE  
THEORY AND PRACTICE  
OF  
SEAMANSHIP:

COLLECTED  
AND ARRANGED  
FOR THE USE OF  
SEAMEN AND  
SHIPMEN.  
**MUSEUM  
BRITAN  
NICVM**

CARTAS MARITIMAS  
OR  
LETTERS OF SEA.

THE SECOND EDITION CORRECTED AND ENLARGED.

---

RICHARD HATFIELD,  
PRINTER TO THE CROWN,

---

1795.

TO THE  
HONOURABLE  
THE  
COURT OF DIRECTORS  
OF THE  
UNITED COMPANY OF MERCHANTS OF  
ENGLAND,  
TRADING TO THE EAST INDIES,  
THIS WORK,  
(BY THEIR PERMISSION,)  
IS HUMBLY DEDICATED,  
BY THEIR VERY OBEDIENT,  
AND FAITHFUL SERVANT,

*R. H. GOWER.*

HONORABLE  
ADMISSION  
CORPORATION  
SECOND EDITION  
UNITED STATES INDEX

THE HUMOR OF DECAYED  
LITERATURE

---

## **ADVERTISEMENT**

### **SECOND EDITION.**

**I**N justice to the Author, it becomes necessary for him to state, that during his late voyage to India, Mr. Steel, a bookseller, of Union-row, Little Tower-hill, republished nearly the whole of the 2d, 3d, 4th, 5th, 6th, 7th, and 8th chapters of the first edition of this work, in a voluminous compilation termed, “Elements and Practice of Rigging and Seamanage.” However illiberal such treatment must appear to the truly generous mind, the Author would the more freely forgive

Mr. Steel, had he not, by artfully endeavouring to evade the piracy, been guilty of such misrepresentation, as has a tendency to bring his professional knowledge in question. Several deviations of this sort are contained in the 2d volume, 4to, of Mr. Steel's work, and are produced to shew that the Author has just reason for complaining.

## MOTRIS AND SODIES

1st, In page 282 of Mr. Steel's work, the figure at the front of This treatise (which is original) is deviated from, by the introduction of a useless moveable circle.

2d, In page 284 of Mr. Steel's work is a problem from the first edition of this Treatise "Upon the Stability of Vessels." In this problem Mr. Steel has introduced a fourth point, by the name of *metacenter*, which one might suppose, was introduced for the purpose of bewildering the reader; however, after reading it several times over, it may possibly be concluded that the *metacenter* and *centre of motion* are the same thing; particularly if the reader omits the forced conclusion of the third

para-

paragraph; and, indeed, if Mr. Steel will grant, that *whatever part of a lever touches the fulcrum, that point is the centre of motion*, he himself must draw the same conclusion; for by his own account the *metacenter* is the acknowledged *prop or fulcrum*; therefore, the *metacenter* and *centre of motion* are the same thing. Such an alteration of the original destroys its simplicity, and introduces the absurd attempt at making *a lever play upon two fulcrums at the same time.*

3d. In page 302 of Mr. Steel's work, is a problem entitled—"Of Mooring with two, three, or more Anchors a-head." I confess when I read the title, I expected also to find two, three, or more anchors astern; instead of which, after a few introductory lines, I met a problem, from this Treatise, entitled, "To let go all the Anchors to the best Advantage;" what resemblance there is between the substance of this problem and Mr. Steel's title, I am at a loss to discover. But it accords with Mr. Steel's idea of mooring vessels extremely well; for in the plate facing page 302 of his work,

work, figures 1, 2, and 3, are representations of ships moored with both anchors a-head!

In this edition, the reader will find much new and original matter; also, a System of Naval Signals.

## CONTENTS.

# CONTENTS.

---

## C H A P. I.

### RESPECTING THE PROPERTIES OF VESSELS, AND THE ACTION OF FLUIDS.

	Page
<i>Upon the Floating of a Vessel</i>	1
<i>Upon the Centre of Gravity</i>	2
<i>Upon the Centre of Cavity</i>	ib.
<i>Upon the Centre of Motion</i>	ib.
<i>Upon the Stability of Vessels</i>	4
<i>Upon the Difference of Stability between the Length and Breadth of a Vessel</i>	6
<i>Remarks upon the Stability and Rolling of a Vessel</i>	8
<i>Upon the direct and oblique Impulses of Fluids</i>	10
<i>A Fluid strikes a Surface perpendicularly as the Square of its Velocity</i>	ib.
<i>Upon the Points Velique</i>	12
<i>Respecting the Action of the Wind upon &amp; Sail, and its Centre of Effort</i>	14
	<i>Respecting</i>

	Page
<i>Respecting the Action of a Sail upon a Vessel</i> - - - -	15
<i>Respecting the Action of Sails upon a Ship before and abeam the Centre of Gravity</i> - - - -	16
<i>Respecting the Rate of a Vessel's Sailing</i> - - - -	ib.
<i>Of the Proportion in which the Wind is apparently lessened by a Vessel's sailing large; also in what Proportion more Sail increases her Rate</i> - - - -	18
<i>Upon the best Angle to brace a Yard up to, in Oblique Winds, for its Sail to contribute the greatest Head-way</i> - - - -	21
<i>Upon the Effect of the Rudder</i> - - - -	22
<i>Upon the most advantageous Angle for the Rudder to make with the Keel</i> - - - -	23

---

## C H A P. II.

## UPON MANEUVRING A SHIP UNDER SAIL.

<i>To tack a Ship</i> - - - -	28
<i>Explanation of the large Figure at the Front of the Book</i> - - - -	30
<i>Demonstration of tacking a Ship by the Figure</i> - - - -	31
<i>To Veer a Ship</i> - - - -	33
<i>Demon-</i>	

<i>Demonstration of Veering a Ship by the Figure</i>	34
<i>To Box-haul a Ship</i>	ib.
<i>To Club-haul a Ship</i>	35
<i>To make a Stern-board</i>	36
<i>The Manner of setting in a Squall</i>	ib.
<i>The Manner of setting when a Ship is brought by the Lee</i>	37
<i>To Bear a Ship off, and the Method of setting when taken aback</i>	ib.
<i>Upon Lying-to</i>	39
<i>To Heave-to under the Top-Sails</i>	ib.
<i>Of sounding with the Deep-Sea-Lead, and the Manner of Heaving-to, to find Bottom at great Depths</i>	41
<i>Of Lying-to in a Gale of Wind</i>	42
<i>Upon a Floating-Anchor to ride a Vessel in a Gale of Wind</i>	44
<i>Construction of a Floating-Anchor</i>	45
<i>Upon Reefing</i>	46
<i>Upon Scudding before the Wind in a hard Gale</i>	47
<i>Upon Steering</i>	48
<i>Upon Veering under a Main-sail, and Fore-stay-sail in a Gale of Wind</i>	49
<i>Upon Checking a Ship round in a Tide's-way with a Kedge-Anchor and Hawser</i>	51
<i>Upon Drifting to Windward by the Tide</i>	52
<i>Upon</i>	

<i>Upon Kedging, or Drifting in Calm Weather by the Tide</i>	55
<i>Upon the manner of Kedging in the River Ganges, Bengal</i>	ib.
<i>Upon Trimming the Sails</i>	56
<i>A Vane does not shew the absolute Direction of the Wind when sailing obliquely to it</i>	59
<i>Upon the Action of the Jib and Stay-sails</i>	60
<i>Upon the Position of the Masts</i>	ib.
<i>A Ship will not always sail the faster for more Sail</i>	ib.
<i>Upon taking bad-sailing Vessels in Tow with the least Detention</i>	61
<i>Upon Chasing to Windward</i>	62
<i>Upon Chasing to Leeward</i>	64
<i>Observations for the Chase</i>	66
<i>Upon Sailing against a Sea</i>	67

---

## C H A P. III.

## UPON COMING TO AN ANCHOR.

<i>To bring a Ship to an Anchor with a Side-wind where there is no current</i>	69
<i>To come to an Anchor with the Wind aft, where there is no Current</i>	70
<i>To come to an Anchor without Tending</i>	71
	72

<i>To come to an Anchor upon a Weather-Tide</i>	71
<i>To come to anchor upon a Lee-Tide</i>	ib.
<i>To let go all the Anchors to the best Advantage</i>	73

---

## C H A P. IV.

## OF KEEPING A CLEAR ANCHOR.

<i>Upon the Nature of Sheering a Vessel to one Side of her Anchor</i>	74
<i>To tend a Ship for a Weather-Tide</i>	76
<i>To Tend a Ship with the Wind a few Points across the Tide</i>	77
<i>To Tend a Ship with the Wind across the Tide</i>	78
<i>Of keeping a clear Anchor in Calm Weather</i>	79
<i>Demonstration of the preceding Rules</i>	ib.
<i>At single Anchor, when to let go a second Anchor</i>	82
<i>Upon Veering away Cable in a Gale of Wind</i>	83

## C H A P. V.

## UPON MOORING, &amp;c.

	Page
To Moor in a Tide's-way.	84
To Moor with a Swivel, half a Cable each Way	85
To Moor with an open Hawse to any particular Quarter	86
Of keeping a clear Hawse	ib.
Upon riding Hawse	88
How to act when riding hard between the Cables	90
To Unmoor a Ship	91
To present a Ship's Side to an Object a-bead, when either Wind or Tide- rode	92

---

## C H A P. VI.

## UPON GETTING UNDER-WAY.

To cast a Ship, riding Head to Wind, in a Place where there is no Tide	93
To cast a Ship when Tide-rode with the Wind ahead	94
Upon	

<i>Upon getting a Ship Under-way with a leading Wind in a Tide's-way</i>	94
<i>To cast a Ship from her Anchor, upon a Lee-tide, and back her astern clear of Danger</i>	95

## CHAP. VII.

RESPECTING CARRIERS, VENTURES, AND  
SOPPERS.

## C H A P. VII.

**UPON SETTING AND TAKING IN SEVERAL SAILS  
IN BLOWING WEATHER.**

<i>To set a Main-Sail in a Gale of Wind</i>	96
<i>To set a Top-Sail in a Gale of Wind</i>	97
<i>To take in a Course in a Gale of Wind</i>	98
<i>To take in a Top-Sail in a Gale of Wind</i>	ib.
<i>To take in a Jib, when blowing Fresh</i>	99
<i>To haul in a Lower-studding-sail, blowing Fresh</i>	ib.
<i>To haul down a Top-mast Studding-sail, blowing Fresh</i>	ib.
<i>To brail up and haul down a Main-top-mast Stay-sail, blowing Fresh</i>	100
<i>To brail up a Mizen, blowing Fresh</i>	ib.
<i>To take in a Top-gallant-sail, blowing Fresh</i>	ib.
<i>To bend a Course</i>	101
<i>To bend a Top-sail</i>	ib.

To unbend a Course, in a Gale of Wind	102
To unbend a Top-sail, in a Gale of Wind	103

---

## C H A P. VIII.

RESPECTING CABLES, NIPPERS, AND  
STOPPERS.

Upon coiling Cables	-	104
On splicing Cables	-	105
Upon Serving Cables	-	106
Of an approved Dog-stopper	-	ib.
Of an approved Bit-stopper	-	107
Upon Ring-Ropes	-	108
Upon Nippers, and the Manner of clapping on a Racking Nipper	-	109

---

## C H A P. IX.

## UPON PURCHASES, AND FRICTION.

Upon the Crow, Hand-spec, and Stern-bar	-	110
Upon a Whip-Purchase	-	113
Upon a Tackle	-	ib.
		Of

<i>Of the greatest Purchase to be gained by Blocks</i>	114
<i>Upon the Purchase gained by Swivelling off</i>	115
<i>Upon Dead-eyes, Hearts, and Thimbles</i>	116
<i>A general Rule for calculating the Power of Purchases</i>	117
<i>A Mechanical Increase of Power is Loss of Time</i>	118
<i>Upon Friction</i>	ib.

---

## C H A P. X.

<b>UPON LEAKS</b>	120
-------------------	-----

---

## C H A P. XI.

<b>UPON STOWAGE</b>	125
---------------------	-----

---

## C H A P. XII.

## MISCELLANEOUS ARTICLES.

<i>Upon the Polarity of a Sewing Needle</i>	126
<i>Upon</i>	

	Page
<i>Upon smoothing the surface of the Sea, for the Purpose of Landing a Boat</i>	127
<i>To preserve a Boat from Foundering in a Gale of Wind</i>	128
<i>On the Manner of acting upon Acci- dents happening to the Helm; and a Description of a temporary Rudder</i>	129
<i>To Steer a Vessel which has lost her Rudder, by another Vessel</i>	131
<i>Upon recovering a Vessel upright, without cutting away her Masts</i>	132
<i>To clear Vessels that have run aboard each other</i>	133
<i>Upon Steering a Ship which has lost her Fore-mast</i>	134
<i>Upon hauling a Vessel off a steep Shore in a Calm</i>	135
<i>To prevent rolling away the Masts upon coming out of Port, with new Rigging, immediately into a high Sea</i>	136
<i>A Mode of fitting Top-gallant-sails, that they may be taken out with Ease</i>	ib.
<i>Upon diminishing the Steeving of Bow- sprits</i>	137
<i>Upon</i>	

<i>Upon equalizing the Sails, Yards, and Masts, of the Fore and Main-masts</i>	138
<i>Upon Compasses, and Binacles</i>	<i>ib.</i>

---

## C H A P. XIII.

## U P O N M A N C E U V R I N G A F L E E T

<i>Of the Command and Division of Fleets</i>	140
<i>Of the Order of Sailing</i>	141
<i>Of the Order of Battle</i>	<i>ib.</i>
<i>Of the Order of Retreat</i>	<i>ib.</i>
<i>Of the Lines of Bearing</i>	142
<i>Of Manoeuvring in Succession</i>	<i>ib.</i>

## P R O B L E M I.

<i>To form the Order of Sailing in Three Lines, the Fleet being irregular</i>	143
---	-----

## P R O B. II.

<i>From the Order of Sailing, with the Wind astern, to form the Order of Battle</i>	<i>ib.</i>
---	------------

## P R O B. III.

*From the order of Sailing with a Side Wind, to form the Order of Battle on the same Tack*

Page

145

## P R O B. IV.

*From the Order of Sailing with the Wind aft, to form the Order of Retreat*

146

## P R O B. V.

*From the Order of Sailing with a Side Wind, to form the Order of Retreat*

147

## P R O B. VI.

*From the Order of Battle to form the Order of Sailing, on the same Tack, upon particular Bearings*

148

## P R O B. VII.

*From the Order of Battle, to form the Order of Retreat*

ib.

## P R O B.

## P R O B . VIII.

IX.	Page
<i>From the Order of Retreat to form the Order of Sailing, with the Wind on the Starboard Side</i>	<i>149</i>

## P R O B . IX.

<i>From the Order of Retreat, to form the Order of Battle</i>	<i>150</i>
---	------------

## P R O B . X.

<i>To work to Windward in the Order of Sailing</i>	<i>151</i>
--	------------

## P R O B . XI.

<i>To work to Windward in the Order of Battle</i>	<i>152</i>
---	------------

## P R O B . XII.

<i>To restore the Order of Battle, should the Wind come forward less than six Points</i>	<i>153</i>
<i>Demonstration of the foregoing Rule for bearing up</i>	<i>ib.</i>

## P R O B .

## PROB. XIII.

	Page
To restore the Order of Battle, should the Wind draw aft less than six Points	154
To regulate the Distances of the Ships	ib.

---

## X. 18029

## C H A P. XIV.

## ON SIGNALS.

Mode of expressing 999 Numbers by Eleven Flags and One Pennant	156
Significations - - -	160
General Significations - - -	161
Hours after Dark - - -	163
Points of the Compass - - -	164
Significations which may be expressed by Ships of the Fleet - - -	ib.
Significations addressed to particular Ships - - -	165
Question-Significations - - -	166
Answering-Significations - - -	ib.
Significations respecting Anchoring, and	

	Page
<i>and such as will apply only when at</i>	
<i>Anchor</i>	167
<i>Regular Manoeuvring-Significations</i>	168
<i>Significations appertaining to Battle</i>	169
<i>Night-Signals</i>	170
<i>Significations</i>	171
<i>Instructions and Remarks</i>	172
<i>Fog-Signals</i>	173
<i>Significations</i>	ib.
<i>Instructions</i>	174

( 2 )

191 तिर्यक् च वृषभः वृषभः वृषभः  
192 वृषभः वृषभः वृषभः वृषभः  
193 वृषभः वृषभः वृषभः वृषभः  
194 ६ वृषभः वृषभः वृषभः वृषभः  
195 ५ वृषभः वृषभः वृषभः वृषभः  
196 ४ वृषभः वृषभः वृषभः वृषभः  
197 ३ वृषभः वृषभः वृषभः वृषभः  
198 २ वृषभः वृषभः वृषभः वृषभः  
199 १ वृषभः वृषभः वृषभः वृषभः

## ERRATA,

which the Reader is requested to alter *with a pen.*

Page 124, line 16, for *bring*, read *bung*.

Page 156, 6th line from the bottom, omit the words  
which may have been.

( 4 )

---

**TREATISE  
ON THE  
THEORY AND PRACTICE**

OF

**SEAMANSHIP.**

**C H A P. I.**

**RESPECTING THE PROPERTIES OF VESSELS,  
AND THE ACTION OF FLUIDS.**

*Upon the Floating of a Vessel.*

FOR a vessel to float, she must displace a bulk of water equal to her weight; from whence it follows, that as much water as would fill the cavity the ship has made, would be the exact weight of the vessel and her contents. For, imagine a vessel floating in water perfectly tranquil to be suddenly lifted out, the tranquillity will be immediately disturbed, and the water will rush from the surrounding parts to restore the equilibrium, which will not be perfect till

the cavity is filled up. Now, if it is considered that an equilibrium can only be brought about by an equal momentum, it is clear, that the water which now fills up the cavity exerts as much force on its surrounding water, as the ship in the former case; therefore their weights must be precisely alike.

### *Upon the Centre of Gravity.*

The centre of gravity of a body is that point by which it may be suspended, and the parts remain in perfect equilibrium.

### *Upon the Centre of Gravity.*

By the centre of cavity is meant the centre of the hollow the vessel makes in the water, which is also the centre of the force that the water exerts to support the vessel.

### *Upon the Centre of Motion.*

Respecting the place of the centre of motion, authors have differed. To me it appears to be at the centre of the round of the vessel's bottom; and, if the bottom is perfectly circular, that it will not change its situation, though the centre of gravity of the vessel should variously alter.

Let us farther consider this point: suppose a hollow cylinder, the half of which in some measure approaches the shape of a vessel, to be loaded at one part of its interior surface till it will swim in water the depth of its centre parallel to its length; then let it be rolled to and fro, and its centre will be found to have the least motion. Now, let the same load be moved higher up towards the centre of the cylinder, the surface of the water will still cut the centre of the cylinder, as the load has not been lessened; and if it be rolled, the centre will yet be found to have the least motion.

Again: let the load be reduced, so that the centre of the cylinder may float above the water; roll it, and it will be seen that the least motion is yet in the centre of the cylinder, for the centre cannot be brought nearer to the surface of the water; and in every possible case, be the load light or heavy, and the centre of gravity variously altered; still the centre of motion will ever be at the centre of the cylinder; from which it may be concluded that the centre of any similar body, as a vessel, will also be the centre of motion. Having established the three foregoing points, we shall proceed to explain the reason of the stability of vessels.

*Upon the Stability of Vessels.*

The stability of a vessel depends upon the momentum of her centre of gravity, which must be placed below the centre of motion; and the greater the momentum, the greater will be her stability.

The momentum may be increased by two means. First, by augmenting the weight so that the centre of gravity may preserve the same distance from the centre of motion; or, by placing the same weight lower in the vessel, that the centre of gravity may be removed farther distant from the centre of motion. Let us consider stability by the assistance of a figure.

Let the half circle ABD, plate 1, fig. 1, represent the transverse section of a vessel's bottom; HO the surface of the water; M the centre of motion; C the centre of cavity; G the centre of gravity; and the line GM the vertical axis of the vessel, which may be turned round the point M as on a fulcrum conceived to be supported by the centre of cavity C. By thus simply considering the vessel as a lever in the direction of her vertical axis playing round her centre of motion, it is plain, that if the centre of gravity was placed above the point M, the vessel would upset; therefore, that the ship may have stability the centre of gravity must be below his point.

A little

A little reflection will show, that the centre of cavity and motion are ever in the same vertical line to the horizon; but that the centre of gravity may be on either side this line, according to the inclination of the vessel. While  $G$  is immediately beneath the centre of motion, its action is to preserve the vessel in her erect state; but directly she is inclined, its action is to reinstate her; and this with a power increasing as the vessel inclines, and as  $G$  rises through the quadrant  $GP$ . This power is as the horizontal distance of the gravity from the fulcrum, which distance is equal to the sine of inclination; for, let  $GMg$  be the angle of inclination, then  $QM$  will be the horizontal distance of the gravity from the fulcrum, but  $QM$  is equal to  $g G$  the sine of inclination—therefore the momentum of gravity, or a vessel's stability with any inclination, may be expressed by multiplying the gravity by the sine of inclination.

Also, if the gravity be placed lower in the vessel, for instance, at  $B$ , it is readily seen, that with the same inclination, the stability is greater, for the gravity is removed from the fulcrum, equal to the horizontal distance  $Bb$ , which is greater than  $Gg$ .

*Upon the Difference of Stability between the Length  
and Breadth of a Vessel.*

Let us now examine why there is so great a difference of stability between the length and breadth of a vessel. A vessel easily inclines round her longitudinal axis, but is with much difficulty inclined round her transverse axis. For this purpose let HO, plate 1, fig. 2, represent the surface of the water; HGO the curve of a vessel's longitudinal section, of which E is the centre; and let the smaller circle represent the curve of her transverse section, of which B is the centre; and G the centre of gravity of the vessel. Now, if the vessel be given an inclination round her longitudinal axis, B is the centre of motion or top of the fulcrum which she turns upon; and supposing the inclination equal to the angle GBK, her stability will be expressed by the gravity G multiplied by GK; but if she be given the same inclination round her transverse axis, in which case E is the centre of motion, her stability will then be as the gravity G multiplied by BI, which is considerably greater than GK. This being the case, it follows, that the force necessary to give a vessel an inclination round her transverse axis, must be as much greater

greater than the force necessary to give her the same inclination round her longitudinal axis, as the line B I is longer than G K.

At present we have only examined the stability of vessels upon a supposition that their bottoms are circular; we shall now shew, that, by increasing their breadth, the stability may be greatly augmented.

Let us suppose that the transverse section, plate 1, fig. 1, be allowed more beam, and increased by the dotted lines. Now, when this vessel is rolled over, it is plain that the cavity will be augmented towards the side O; of course its centre must remove towards O, say to E, and as E is ever beneath the centre of motion, erect E m, and where it cuts the vertical axis of the vessel, that point, in the present case, will be the centre of motion. Now, admitting that the vessel be inclined equal to the angle G M g as before, or E M' g, which is the same; then her stability will be expressed by the gravity G multiplied by R g, but with this same inclination in the former case, where the vessel's bottom was supposed to be circular, her stability was expressed by G multiplied by G g, which is considerably less than R g. Therefore, by increasing the vessel's beam, there is a gain of stability equal to the difference of the lines G g and R g. The same reasoning will tend to shew, that if the longitudinal section, plate 1, fig. 2, was increased

increased at the bow simular to the dotted curved line, a vessel's stability may be yet more augmented by her build, with respect to her length.

For the sake of simplicity, in the foregoing reasoning respecting stability, the gravity of the vessel above the centre of the motion, which is acting in opposition to that below, has not been considered. Therefore, to have an exact knowledge of any vessel's stability with a given inclination, it will be necessary to gain the momentum of the gravity which is above the centre of motion, and the momentum of the gravity which is below the centre of motion; then the momentum above (which must ever be the least,) being subtracted from the momentum below, will leave the stability.

### *Remarks upon the Stability and Rolling of a Vessel.*

When sailing in smooth water, the greater the stability the better; but if a vessel with a heavy cargo, stowed low in her bottom, be sent out into a rough, tempestuous sea, where every wave will throw her from her equilibrium, she will return with such violence as to endanger her masts; and should she be dismasted, her roll will then be with still greater force, possibly to the destruction of her hull. Was the cargo in this labouring vessel to be removed higher up towards the

centre

centre of motion, so as to lessen her stability, she would be found considerably easier; her roll would be by such deliberate motions, as to lessen the danger to her masts and hull.

The rolling of a vessel also may be considerably moderated by increasing the keel, as practically appears by experiments made on board vessels with sliding keels; but as increasing the keel of a vessel augments her draught of water, the same may be effected by bolting a keel upon the bilge, on each side, about a third from the keel to the water-mark, making an angle with the vertical axis of the vessel of about 15 degrees, as represented by plate 1, fig. 14, at E E, that when the vessel is upon a wind, and inclined over, the lee-keel may be vertical. It is not intended that these keels should extend the whole length of the vessel, but as far as may be thought convenient. Along the bilge, their bottom should run parallel with the proper keel, that in case of grounding, a greater number of timbers may bear the weight. Thus three advantages would be acquired, viz. moderating the roll, holding a better wind, and greater security when grounded.

It is not out of place to remark, that, even in a calm, bracing up the yards and setting the stay-sails will very much contribute to moderate the rolling of a vessel, though certainly at the expence of the sails.

*Upon*

equivalent and equal to an impulsion of three.

*Upon the direct and oblique Impulses of Fluids.*

In considering the impulses of fluids it must be remembered, that it is of no consequence whether the fluid strike the body, or the body the fluid; that is, the impulsion against the bow of a ship at anchor in a tide of three knots, is the same as if the ship sailed three knots through the water.

**T H E O R E M.**

*A Fluid strikes a Surface perpendicularly as the Square of its Velocity.*

**D E M O N S T R A T I O N.**

When a body in motion strikes perpendicularly another, which is at rest, it is with its momentum, that is, with a force equal to its mass multiplied by its velocity; and if the mass of the body be called one, it is easily conceived that a body will strike or impel another with a force that may be expressed by its velocity; but a body moving in a fluid will have to encounter more bodies in the same time as its velocity increases, for with six times the velocity it will encounter six times the number of bodies or particles; and each particle will strike with six times the original force; therefore the body in motion will be shocked.

shocked by the fluid with an impetus of six times six, which is the square of the velocity.

For the sake of an example to elucidate this matter, suppose six shots be placed in succession at a foot distant from each other, and that a body be forced against them with the velocity of one foot in six minutes; in six minutes, therefore, it can receive only the impulse of one shot; but if the body be given six times the velocity, in six minutes it will have received the impulse of all the shot, and each shot, by this increase of velocity, must strike with six times its original force; therefore the body will have received a shock equal to six times six, which is the square of the velocity.

Though a fluid strikes a surface perpendicularly as the square of its velocity, yet, if the surface be presented obliquely to the fluid, its force will then be diminished as the square of the sine of incidence: for, if a body or particle as A, plate 1, fig. 3, strikes a surface B D at B, with the direction and force A B, it will be deflected off in the direction B E, and impart to the surface a perpendicular force B C, which is equal to A D, the sine of the angle of incidence.

Again: should a surface be placed perpendicular to the motion of a fluid or number of particles, it will then be struck by as much as it can oppose; but if the same surface be presented obliquely

liquely to the fluid, it will not then oppose so much of it by the sine of the angle of incidence: for, let D C, plate 1, fig. 4, represent the direction of the fluid; A B the surface opposed to it perpendicularly, in which position it will obstruct all the fluid passing between the lines A and B; but if this surface be placed obliquely to the fluid, as A C, it will only obstruct the quantity between the lines A and D, which are separated by the sine of the angle of incidence A C D; therefore the force of a fluid against an *oblique* surface diminishes from two causes; first, because the particles of the fluid, by striking the surface obliquely, do not exert upon it their whole force; and, secondly, because there are not so many particles striking: both of which diminutions following the ratio of the sine of incidence, the total diminution is the square of the sine of incidence.

#### *Upon the Point Velique.*

By the point velique is meant that point where a perpendicular from the centre of gravity of a vessel is met by a line in the mean direction of the effort of the water upon the bow. To explain this more clearly: let A B, plate 1, fig. 5, represent the keel of a vessel; B C the curve of the bow; A D a perpendicular through the cen-

tre of gravity ; C D the mean effort of the water upon the bow ; then the point D is the point velique : and let the force applied against D, in a direction to push the vessel onward, be ever so great, it can only tend to give her a direct motion, and raise her in the water parallel to herself ; but should the force be applied above that point, the bow will be forced down into the water ; if below, the bow will be lifted out of the water ; in either case altering the trim of the vessel. This point can only be exactly found when sailing before the wind ; for by sailing obliquely to the wind, C D will come from the lee-bow, and pass to windward of the perpendicular without cutting it ; therefore in this case there will be no determination.

From what has been said of the point velique, it may be easily concived, how necessary it is that all vessels should have their masts of such a height, that the centre of effort of the sails may meet, or be the same height with it, otherwise the forcing the vessel from her parallelism may greatly retard her sailing, and make her labour extremely, particularly in a high sea.

Till the shapes of vessels bows beneath the surface of the water shall be a curve whose properties are known, it will be difficult to establish by calculation the height of the point velique ; but experiment upon a small scale would assist us, though it may not perform all that could be wished.

wished. Thus, let a small vessel be built perfectly similar to the large vessel whose point velique is required to be known. In this fix a mast as A D, plate 1, fig. 5, and being properly ballasted, place it in a trough of water. Now let the vessel be drawn along by a horizontal line D E, leading over a pully, to which is fixed a weight; and wherever this line shall be so fixed to the mast as to draw the vessel along, in the same parallel position she floated in when at rest, there is the point velique. It will be necessary to have an upright at the bow of the vessel, with a slit for the line to lead through, that the vessel may follow in a right line.

*Respecting the Action of the Wind upon a Sail, and its Centre of Effort.*

The action of the wind upon a sail is perpendicular to its surface; and if the wind strikes it perpendicularly, the centre of effort will be the middle of the sail; but, if the wind strikes the sail obliquely, the centre of effort will be removed towards the weather-leech.

**DEMONSTRATION.**

Let B D, plate 1, fig. 6, represent the surface of a sail; A B, C D, the direction of the wind striking the sail.

striking the sail. Now, if C D strike the sail near the weather-leech, as for instance, at D, it will be deflected in the direction D E, and impart a force to the sail in the direction D F; but if the lee-leech is struck by the wind A B at B, it will be deflected off towards E, and will not impart the same force; for A B must lose a great deal of its force by having to pass through all the deflected wind between D and B. The same reasoning may be applied to the wind's striking any intermediate part of the sail, and proves that the wind gradually loses its power as it strikes nearer the lee-leech; which must cause the centre of effort to approach the weather-leech with an oblique wind. This is practically seen by the strain always reefing upon the weather-brace.

#### *Respecting the Action of a Sail upon a Vessel.*

The action of a sail upon a vessel, if the yard be square, will be to force her in the direction of her keel, either ahead or astern; but if the yard be braced up obliquely to the keel either way, the sail will act two ways, one in the direction of the keel, the other in the direction of the beam; yet though the yard should be so braced, as to cause the action in the direction of the keel and beam to be alike, still the head-way or stern-way will considerably exceed the lee-way, because

the

the head or stern of a vessel meets less resistance from the water than either side.

*Respecting the Action of Sails upon a Ship before and abaft the Centre of Gravity.*

Let A E, plate 1, fig. 10, represent the longitudinal axis of a ship; C the centre of gravity, or point round which the ship would turn; A the centre of action of the sails upon the fore-mast; D the main-mast; E the mizen-mast. Now, should the momentum of D and E act on the same side, and be equal to the momentum of A, no rotation of the ship would follow; but should this momentum be lessened, or taken off, either before or abaft the centre of gravity, the ship will immediately revolve with a less or greater motion. From which reasoning it follows, that with the head sails full, and the after sails shaking, the ship will veer; but with the after sails full, and the head sails shaking, the ship will come to. Likewise, if the sails before and abaft the centre of gravity be equally trimmed, the ship will neither fall off nor come to.

**RESPECTING THE RATE OF A VESSEL'S  
SAILING.**

**THEOREM.** — *A Vessel proceeds in Proportion to the Velocity of the Wind.*

The motion of the vessel is accelerating, till the pressure of the water on the bow, to oppose

her

her course, is equal to the pressure of the wind upon her sails to push her forwards, when she will proceed with a uniform motion, in proportion to the velocity of the wind, *not as its force*, as it is often imagined she does.

It must be remembered, that the force or pressure of a fluid is as the square of the velocity; the velocities 4, 8, 12, producing the forces 16, 64, 144.

A vessel at first getting under way, with the wind a-beam at a velocity of four, will proceed onwards with an accelerating rate, till the pressure of the water at the bow be equal to sixteen, (the same as the wind upon the sails) when she will proceed uniformly as the velocity of the wind, since the ratio of its strength is counteracted by an equal ratio of pressure at the bow.—Let it be presumed, for the sake of example, that this vessel sails a fourth part of the velocity of the wind; then with a wind blowing 4 she will sail at the rate of 1, and with the wind blowing 48 she will sail but 12, though its pressure has increased 144 times! After these considerations, all difficulty will cease: nor ought we to be surprised at the reduction of a vessel's rate when hauled upon a wind, notwithstanding more sails draw, since the pressure of the wind upon the slowest sail or even upon the best sail

sails is reduced as the square of the sine that the former angle of incidence bears to the square of the present, which reduction is greater than the advantage arising from the drawing of the head-sails and stay-sails.

*Of the Proportion in which the Wind is apparently lessened by a Vessel's sailing large; also in what Proportion more Sail increases her Rate.*

A vessel's progressive motion apparently increases or diminishes the velocity of the wind, by as much as she advances to or recedes from its source. With the wind right aft, she recedes from it the whole of her progressive motion; and with the wind between aft and abeam, she recedes from it *as the cosine of the angle contained between the stern and the wind.* To explain which, let BF, plate 1, fig. 3, represent the direction of the wind, and the radius of the circle the vessel's velocity in a given time; then, by her sailing the course BA, with the wind upon the quarter, it is evident she will recede from it by the distance DA only, which is the co-sine of BAD, the angle which the wind makes with her stern. With the wind abeam, she neither recedes from nor advances to the wind; from whence it follows, that, with a beaming wind, a vessel must continue to sail faster, while more

more canvas can be spread to advantage, there being (mathematically speaking) no limitation to her rate; but with the wind large, spread what canvas you will, yet there must be a limitation—it being clear, that while she recedes from the force which impels her, in time it must lose its power. Notwithstanding, a vessel will not increase her rate in proportion to the increase of canvas; that is, with twice or three times the canvas, set to equal advantage, she will not sail twice or three times as fast, but the increase will be in the following ratio:—as the quantity of canvas at first set, is to the quantity now set, so is the square of the first rate of sailing, to the square of the present rate. For example, suppose that with 100 yards of canvas a vessel should sail 4, with 225 yards she will sail but 6; for 100 is to 225, as 16 is to 86, the square of the acquired rate. This being the case, how absurd is it to carry small sails at the risk of the masts; for if a royal or top-gallant studding-sail be called a one-hundredth part of the quantity of canvas, set with a beaming wind, (at which time, let it be presumed, the ship is sailing ten knots) then it will increase her rate but to ten knots  $\frac{5}{100}$ ! A 100, the former canvas, being to the increased canvas, which is 101; as 100, the square of the first rate, is to 101 the square of the acquired rate, whose root is 10.05, nearly.

In the foregoing reasoning, we have considered what an increase of canvass will produce with a beaming wind. With the wind large, it will not produce so great an effect, on account of the ship's receding from it; therefore to gain the quantity of canvass that will advance her sailing to a certain rate, with the wind large, we must further increase it in the ratio of the squares of the different velocities of the wind. Thus for example: Suppose a vessel, with 100 yards of canvass set, sails at the rate of 4, with the wind 60 degrees upon the quarter, blowing at the velocity of 16; what quantity of canvass is required to make her sail fix upon the same course?—Since the co-sine of 60 degrees is a proportion of half, the apparent velocity of the wind, when the ship sails 6, will be 15, — 1 being the half of her increased rate; therefore, after having increased the canvass in the ratio of the squares of the two different rates of sailing, which produces 225 yards, still further increase it in the proportion that the square of 15, the last apparent velocity of the wind, bears to the square of 16, the first apparent velocity of the wind, which gives 14 yards; this, added to 225, produces the result, 239 yards.

Open

*Upon the best Angle to brace a Yard up to, in Oblique Winds, for its Sail to contribute the greatest head-way.*

The angle being given between the wind and the keel, it is required to know how this angle should be divided by the yards, that the sails may contribute the greatest head-way.

For this purpose, let KK, plate 1, fig. 7, represent the direction of a vessel's keel; C her beam; AB any of the square-sail yards, as the main-yard; 1.s. the yard braced up 10 degrees more; 2.s. braced up 10 degrees less; WC the direction of the wind. Now, of the angles  $WC_3$ ,  $WCA$ ,  $WC_2$ , one must be more advantageous than the others for increasing the velocity in the direction of the keel.

The action of the wind upon a sail, it should be remembered, is perpendicular to its surface, and the force with which it acts is as the square of the sine of incidence; therefore draw perpendicular to the yard, in the three different positions, the forces CD, CE, CF, proportioned to the squares of the sines of the different angles of incidence  $WC_3$ ,  $WCA$ ,  $WC_2$ , and they will represent the power of the sail upon the vessel in the three different positions of the yard. Now draw the parallelograms CD, CE, CF, each having two sides parallel to the keel, and two to the

the beam, then these sides will represent the lateral and direct forces arising from the three total forces  $CD$ ,  $CE$ ,  $CF$ . The direct forces are those only which we need consider. The position of the yard  $AB$  gives a direct force of  $C_5$ ; the position 3.3, where the yard is braced up 10 degrees less, gives  $C_4$ ; and the position 2.2, where the yard is braced up 10 degrees more, gives the same, which is less than  $C_5$ . Now, as either bracing up less or more from the position of the yard  $AB$ , gives less, it is evident that the position  $AB$  is the best that the yard can make with the keel for increasing the head-way; and this position will never be attained but when the tangent of the angle of incidence  $WCA$  is double the tangent of  $ACK$ , the acute angle that the yard makes with the keel.

#### *Upon the Effect of the Rudder.*

The effect of the rudder is produced by the water passing the vessel and acting upon one side of it; consequently the ship's stern must be forced to the contrary side.

Thus suppose the tiller was put over to starboard; giving the rudder the position  $BC$ , plate 1, fig. 8, and that the vessel be given head-way; then, by the water's passing from  $A$  towards  $B$ , it must necessarily strike against the larboard side of the rudder, and force her stern towards  $D$ ,

D, her head taking the opposite direction towards F, the vessel turning about some point (E) before the centre of gravity. On the contrary, let stern-way be given to the vessel; then, by the water's passing from B towards A, it must act against the starboard side of the rudder, and force her stern towards H, at the same time that her head moves towards I; but, when the helm is in the direction of the keel, the water can act no more on one side of the rudder than the other, therefore no rotation of the vessel will follow.

From the foregoing reasoning the following rule is deduced, which should be well remembered.

If the vessel has head-way, the helm, or tiller, being put astarboard, turns her head to port; if put to port, it turns her head to starboard; and if the vessel has stern-way, the helm or tiller astarboard turns her head to starboard; if put to port, it turns her head to port.

*Upon the most advantageous Angle for the Rudder  
to make with the Keel.*

There certainly must be one angle more advantageous than the rest for the rudder to make with the keel to gain the greatest lateral power. If a figure be drawn representing a fluid striking a surface, as a rudder, at different degrees of

incidence, with forces as the squares of the sines of the angles of incidence; upon examining this figure, it will appear that the greatest lateral impulse, or that which is in the direction of the beam, will be, when the fluid strikes the surface, at about 55 degrees; but then the impulse in the direction of the keel being much greater than the lateral, is consequently destructive of a considerable quantity of the vessel's head-way. Let the incidence of 45 degrees be examined, and it will be found that the lateral and stern impulses are alike, and that the lateral impulse is very little less than that at 55, while the stern impulse has considerably diminished; therefore, it may be concluded, that an angle of 45 degrees is the most advantageous for the water to strike upon the rudder, to gain the greatest lateral impulse with the least stern impulse. To the bottom of the rudder the water certainly comes in the direction of the keel; but above that point, up to the water mark, it must come to the rudder in the different directions of the vessel's run. The mean spread of the run let us suppose to be 20 degrees, the half (10) will then be the angle which the water makes with the keel when thrown out of its direction towards the bow; therefore, for the rudder to be struck at a mean by the water with an angle of 45 degrees, the tiller must move over 35 degrees. This is about .

about the greatest angle that is in general practice, few large vessels having their tillers to go over more.

The foregoing is the reasoning of geometers, and, though perfectly agreeable to truth, is not of that importance which they seem to have imagined. The problem required is, to gain a sufficient lateral impulse for the steerage of a vessel, with the least stern impulse.

This is only to be accomplished by increasing the rudder, and diminishing the angle; thus any required lateral impulse may be gained with an infinitely small angle; but for this purpose, rudders must be increased to a very great size. Admitting that they could be increased with safety one half of their present dimensions, then with an angle of 20 degrees only, nearly the same lateral impulse would be gained, with about half the original stern impulse. This circumstance many are aware of, boats being built for the purpose of swift sailing, with rudders considerably exceeding the accustomed proportion.

It may be remarked, that by increasing the weight of rudders to such an extensive degree, it will be difficult to secure them. Let those who are of this opinion consider, that as rudders are nearly the weight of their bulk of water, only the weight of that part which is above water rests upon

upon the pintles. Should it be further remarked, that such rudders will be torn away by the force of the water against them, I answer, that the whole force of the water against these increased rudders, moved over only 20 degrees, is not so great as the whole force against the smaller rudders, moved over 35 degrees; indeed, it is about one-third less. The advantage of these increased rudders will be, less loss of headway, less labour to the helmsman, and, should the vessel in light winds or in a tide's-way prove sluggish at answering the helm, its power may be increased double, by admitting it to go over 35 degrees.

It is not my wish that rudders should be given their present shape. Let them be made to resemble plate 1, fig. 9. Thus there would be no useless wood above water for the sea to strike against, and they would have breadth where the water strikes nearly in the direction of the keel.

The present mode of hanging rudders on a raking sternpost appears liable to some objections; for, in the first place, when they are moved over, the water strikes with an obliquity which has a tendency to bring the ship by the stern; and secondly, more power is required to overcome the force they naturally exert to return amidships. Were they, on the contrary, hung perpendicularly, these objections would be

be done away; and an additional advantage would accrue to the steerage, by the rudder being hung farther aft.

Having treated of the necessary theory in the preceding pages, we shall in the next chapter enter upon the practical part of seamanship, which every officer, ambitious to be alert at his duty, should make himself perfectly acquainted with; that his mind may be as quick to conceive what ought to be done as a ship is rapid in her evolutions. Was the young marinier, at his leisure hours, to employ his mind in reflecting on the various circumstances to which a ship is liable, and apply his theoretical knowledge to the more immediate event in point, his mind would be stored with many excellent rules which would readily occur to him at the moment of need.

## CHAP.

against the leeward side, view the wind  
and ribbon sail, and all other signs before

## C H A P. II.

## U P O N M A N O U V R I N G A S H I P U N D E R S A I L.

## To tack a Ship.

To tack a ship, let the sails be trimmed sharp, and every man be sent to his station; hands in the tops to bear the back stays abaft and abreast, to shift over the stay-sail-tacks, &c. and let all the ropes be clear and stretched along upon deck; then put the helm down, and call out, *helm's alee, fore sheets, fore-top-bowline, jib and stay-sail sheets let go!* The wind out of the main-sail, *raise tacks and sheets!* and haul well taught the weather after-braces for a good haul. The wind about a point, or two points upon the bow, so as to back the weather-leech of the main-top-sail, *main-sail baul!* sharp round with the after-yards, and watch her way; if she has no way, right the helm; if stern-way, shift it. The after-sails full, *let go and baul!* round briskly with the head-yards, and trim all sharp.

## REMARKS.

Should it blow fresh, be careful to set the back-stays up when in stays.

The

The practice of bracing-to the head-yards, while the ship has fresh way, is disapproved of, as tending to destroy it, thus losing the effect of the rudder, which is of more consequence : and the reason for hauling the main-sail with the wind upon the bow is, that the wind then taking aback the weather-leech of the main-sail and main-top-sail, causes the after-yards to fly round of themselves, bringing the clew of the main-sail flat aft to its proper place, that the people have only to run in briskly with the slack of the sheets and braces.

If the water be tolerably smooth, and the whole evolution be performed with spirit, the ship will seldom get stern-way, and will therefore require only the righting of the helm.

Should the ship after coming about fall off considerably, let fly the jib and fore-stay-sail sheets, and keep in the head-yards till she comes to; then brace up, and trim sharp.

If it be expected, from there being much sea upon the weather bow, that the ship will not come about, it will be proper to haul down the jib and fore-stay-sail before the helm is put alee ; and at all times when these sails are set, the officer forward should be particularly careful that the fore-castle-men do not haul over their sheets too early, which they frequently are guilty

of from an over-anxiousness to be forward with their duty, and thus often prevent the ship from staying. While the helm is putting alee, let it be done gradually, and if the ship has quick headway she will seldom require the helm to be put hard over to bring her about.

It sometimes happens that a ship will refuse staying even after the main-sail is hauled, and from that time fall off. In this case, haul up the main-sail, mizen, and mizen-stay-sail; square the after yards, and keep the helm as it was, for she will have stern-way. This position of the sails and helm will cause her to fall off briskly upon her heel. As the after sails fill and she gathers headway, shift the helm, and proceed as if veering.

Having mentioned the manner of tacking a ship, we may now proceed to explain the *large figure* at the beginning of this work, which is intended to assist the reader with a clear idea of the nature of the various evolutions of a ship.

*Explanation of the large Figure at the Front of the Book.*

The circle represents the horizon; the dashed lines across the circle the wind, blowing from the upper part of it. The figure made to turn

in the centre of the circle, is a representation of a ship moving round her centre of gravity before the main-mast, with her sails and rudder, having their names written upon them. The shade at the head and stern is intended to represent the water passing either aft or forward, as the imagination may conceive the ship to have either head or stern-way. The yards inscribed *fore-yard*, *main-yard*, and *crosst-jack-yard*, may be imagined to represent the whole of the square sails upon each mast, for all the sails upon each mast are as one great sail, having the same action, but divided into smaller for the convenience of being more easily managed.

After this explanation, we shall go through the evolutions of tacking and veering by the assistance of *the figure*, which it is to be hoped will clearly demonstrate the necessity for giving the sails a particular position to effect a particular evolution; and at the same time render its use so familiar, that other evolutions may be attempted without explanation.

#### *Demonstration of tacking a Ship by the Figure.*

To tack the figure, trim it sharp to the wind by placing its head in the direction of the line  $\Delta$ ; then brace the yards up in the directions of

the lines CCC, and bear the jib over to leeward. The figure or ship is then trimmed sharp, six points from the wind upon the starboard tack. Now put the helm alee, and imagine the fore-sheet and fore-top-bow-line to be let go, and move the figure gradually to the wind, as if it were done by the action of the rudder, till her head is in the direction of figure 2. In this situation it is seen that the wind blows right along the yards, of course the wind is now out of the sails; therefore, *raise racks and sheets!* or suppose it to be done. Then move her head further round to the direction of figure 3, about a point and a half from the wind, and it is seen that the head-sails are flat aback, which now contributes most to force round the ship's head, as her way through the water must be nearly at an end, and that the wind catches aback the weather-leeches of the after-sails, therefore, *main-sail baul!* and brace round sharp the after-yards. The sails being now all aback, and the figure moved round head to wind, it may be supposed that the head-way has ceased, and sternway commenced; therefore shift the helm. The figure being moved to bring the wind on the other side, bear the jib over to leeward, and keep moving the figure round till its head is in the direction of the line B, when it will be seen that the after-sails are full;

full; therefore, as the ship is sufficiently from the wind to fill the sails, *let go and haul!* brace round the head-yards, right the helm, and trim all the yards sharp in the direction DDD, and the figure is now six points from the wind, upon the larboard tack.

*To Veer a Ship.*

To veer a ship, send the people to their stations; then haul up the main-sail, mizen, and mizen-stay-sail; put the helm aweather; let go the after-bow-lines, and square away the after-yards. As the sails off, keep squaring the after-yards, just suffering the after-sails to be barely full. When the wind is nearly aft, raise the fore-tack and sheet; let go the head bow-lines, and square away the head-yards. As the wind comes upon the other quarter, brace up the after-yards; haul aft the mizen, and mizen-stay-sail sheets; get on board the main-tack, and haul aft the main-sheet. As she comes to, brace up the head-yards, and get on board the fore-tack; and when she is to the wind, right the helm, haul flat aft the fore-sheet, trim sharp, and haul up the bow-lines.

D  
REMARKS

## REMARKS.

The method of shivering the after-sails is thought improper, as by tending to diminish the head-way much of the effect of the rudder is lost.

*Demonstration of Veering a Ship by the Figure.*

Trim the figure sharp to the wind, as shewn in the foregoing problem; then put the helm aweather, and square the after-yards, in which position of helm and sails it is clear the ship must veer with rapidity, since the power of the after-sails to counteract the helm and head-sails is taken away. Keep squaring the after-yards, and moving the figure from the wind: when the wind is nearly aft, square the head-yards, and brace up the after-yards; in which position they oblige the ship to come to the wind, and at the same time are not counteracted by the head-sails. As the figure is made to approach the point D, keep bracing up the head-yards, and right the helm.

*To Box-haul a Ship.*

To box-haul a ship, haul up the main-sail, mizen, and mizen-stay-sail; raise the fore-tack and

and sheet, and man well the weather head-braces and lee bow-lines; now put the helm aweather; brace sharp aback the head-yards, and haul up the lee-bow-lines; then shiver the after-sails, and keep them shaking as she falls off, which she will rapidly do by the position of the helm and sails. The wind aft and round upon the other quarter, brace up the after-yards; haul aft the mizen and mizen-stay-sail sheets; get on board the main-tack, and trim sharp the after-yards. As she comes-to, trim sharp the head-yards, haul up the bow-lines, and right the helm,

*To Club-haul a Ship.*

Club-hauling is practised when it is expected that a ship will refuse stays upon a lee-shore. To execute it, bend a hawser from the lee-quarter to a kedge-anchor, prepared for letting go from the lee-bow: now place the hands to their stations for putting the ship about, and let hands stand by the anchor; then put the helm down, and should the ship make a stand before she brings the wind ahead, let go the anchor and haul the main-sail. When the wind is ahead, cut the hawser, and the ship will cast the way required. The after-sails full, let go and haul.

*To Club-haul a Ship.*

*To make a Stern-board.*

To make a stern-board, haul down the jib and fore-stay-sail, luff the ship to the wind, and brace sharp aback the yards fore and aft; and when stern-way commences, shift the helm aweather.

*The Manner of acting in a Squall.*

The manner of acting in a squall depends so much on the moment, and on the judgment of the commanding-officer, that it is difficult to prefix any precise rules. Every officer should remember, that all accidents which happen through his persisting to carry sail in a squall entirely appertain to himself. The vigilant seaman should ever be attentive to the weather; and if he sees any clouds arise which he has reason to suspect carry wind with them, let him make the ship snug. For instance: suppose the ship under a crowd of sail with a beaming wind, let the small sails, studding-sails, and driver, be taken in; and should the weather still continue to gather, and a hard squall be expected, let the top-gallant-sails be furled; the jib be hauled down, and stowed; the mizen-top-sail lowered down, and the lee-clew-garnet of the main-sail hauled up: then place hands by the top-sail-haliards,

haliards, and wait the expected wind. Should it come on to blow very strong, keep the ship off from the wind, and lower away the top-sails; when, either reef or hand, as is thought necessary.

*The Manner of acting when a Ship is brought by the Lee.*

When a ship is brought by the lee, it is generally occasioned by neglect of the helmsman during a high sea and a quartering wind. Thus the careless helmsman, by yawing of the ship to leeward of her course, brings the sea upon the other quarter, which, striking the ship with violence, forces her stern round, and causes the wind to come broad on the opposite beam, throwing all the sails flat to the mast. Should the ship continue her way, she will, in all probability, recover her situation by the assistance of the helm, and brailing up the mizen and mizen-stay-sail; but should she lose her way, it will be necessary to brace about the after-yards, and even sometimes the head-yards, to give her fresh way through the water, when she will veer, then trim as before.

*To Box a Ship off, and the Method of acting when taken aback.*

If a ship is in the wind, through neglect of the helmsman, or through the wind coming sud-

denly more ahead, by putting the helm aweather, and brailing up the mizen and mizen-stay-sail; if she has head-way remaining, she will fall off; but should the head-way be at an end, she must be boxed off: to do which, put the helm alee,—raise the fore tack and sheet,—brace sharp round the head-yards,—and haul up the lee-bow-lines: in this position of the sails and helm, she must inevitably fall round off upon her heel. The after-sails being full again, brace about the head-yards, right the helm, and trim sharp as before: but, should a ship be taken flat aback, or through neglect in not timely boxing her off, it should cause the wind to be broad upon the other bow, and it should be the wish of the officer to have her upon the same tack as before, then put the helm over to that side which just before was the weather: brail up the mizen and mizen stay-sail; raise the main-tack and sheet, and square the after-yards. In this situation of the helm and sails, she will pay round off upon her heel; and when she has brought the wind aft, and gathered head-way, shift the helm. The wind round upon the other quarter, haul aft the mizen and mizen-stay-sail sheets, brace up the after-yards, get on board the main-tack, and haul aft the sheet. As she comes to, right the helm, and trim sharp as before.

Upon  
wind

*Upon Lying-to.*

Lying-to may be effected several ways. The art is to produce a balance between the head and after-sails, so that their effects shall counteract each other. When lying-to is intended, the courses are generally hauled up, as being incommodious.

*To Heave-to under the Top-Sails.*

A ship being close hauled under the top-sails, mizen, mizen-stay-sail and jib, it is required to heave her to. Thus situated, it is only throwing the main-top-sail to the mast, and putting the helm a little alee; but should the officer wish to prevent her from fore-reaching, let the mizen-top-sail be thrown sharp aback to the mast, and the helm be righted.

Another method is to throw the fore-top-sail square to the mast, and to put the helm a little alee; and should she fore-reach too much, let the mizen-top-sail be braced sharp aback, and the helm be righted.

## REMARKS.

As a ship will fore-reach while she is lying-to, with only one top-sail aback, she may be kept to

the wind by the power of the helm; but with two top-sails aback, she will sometimes go ahead and sometimes astern, therefore it will be improper to keep the helm either way. For this reason she must be kept to the wind by the assistance of the sails; and as the action of a sail is perpendicular to its surface, the main and mizen-top-sail being braced sharp aback must contribute a very great lateral force upon the ship's stern to keep her to the wind. Again, when the fore-top-sail is braced aback only square, it acts with no lateral power to pay off the ship's head, while the mizen-top-sail, by being sharp aback, keeps her to the wind. If the ship lies well to the wind, the jib had better be kept up in readiness to veer her.

In different situations, both the foregoing methods of lying-to have their particular advantages. If a ship is to be brought-to, to windward of another, the first method should be practised, as then she will be in readiness to fill and shoot clear of the vessel to leeward, should the drift too near her; but if the ship is to be brought-to, to leeward of another, let the second method be practised, for, should the windward vessel drift too near, by bracing sharp aback the head-yards, and shivering the mizen-top-sail, the ship will fall round off upon her heel.

*Original and your sail glands list goes one who does  
not*

Of

*Of sounding with the Deep-Sea-Lead, and the  
Manner of Heaving-to, to find Bottom at great  
Depths.*

To gain the true depth in deep water, it is necessary that the ship shall be perpendicular over the lead at the time it arrives at the bottom. While a ship's head-way does not exceed three or four knots, and the water be tolerably smooth, by passing the line the whole length of the vessel, and swinging the lead from the sprit-sail-yard, soundings can generally be had from 30 to 40 fathoms; but if, from the increasing of the rate, or the deepening of the water, bottom cannot be gained, the ship's head-way must be reduced: this, in moderate weather, will seldom require more than the taking in the small sails, and luffing the ship carefully to the wind. But if a ship be sailing large with a strong breeze, it will be necessary to take in sail and reduce her to the top-sails. Now, the line being passed along clear to the sprit-sail-yard, and the lead ready for heaving; brace to the head-yards, and luff the ship briskly to the wind; and when the head-way shall be sufficiently moderate to suffer the taffarel to come perpendicular to the lead in the time that it could have reached the bottom, then heave the lead. Soundings being gained,

gained, haul in the line briskly; then put the helm aweather, brace about the head-yards, and trim as before.

The bringing the ship briskly to the wind is a great advantage, as it gives time for the lead to reach the bottom, before her drifting to leeward takes place.

Should a ship be dead upon a wind, and drifting considerably to leeward, it will be necessary to pass the line from windward, round the bow, to the lee, fore, or main yard arm, and to swing the lead as far out to leeward as possible, in the direction of the ship's drift, that, by her driving, she may pass over it.

#### *Of Lying-to in a Gale of Wind.*

When a ship upon a wind is obliged to reduce almost the whole of her sails, through hard blowing weather, she is said to be lying-to, and the more her bow can be presented to the wind and sea the better, as she will have less drift. The mode of effecting this, is as circumstances may require. If a ship is to be brought-to in a part where other vessels may be expected to be sailing in a contrary direction, the best sails to lie-to under are, a reefed fore-top-sail, mizen-stay-sail, and storm-mizen\*, with the helm so much alee as

A triangular sail to hoist upon a horse abaft the mizen-mast, having foot-rope enough to haul well aft to the taffrail.

is found best to answer the purpose. The reason for not putting the helm hard alee, which is the usual custom, is this, that when the helm is hard alee she will come up in the wind and shake the sails, causing her to get stern-way, and fall round off. On the contrary, were the helm never put so far over as to oblige the ship to come up in the wind, she would come-to and fall off much less: a ship thus brought-to will be in readiness for veering in case of necessity. Where there is good sea room, a reefed main-sail, storm-mizen, and mizen-stay-sail, are excellent sails to lie-to under, as a ship will keep to the wind under these sails without much of the lee-helm, and for that reason be very little subject to fall off or come-to in any considerable quantity.

If the sea be extremely high, and the ship very stiff and labouring, she will lie-to better under a main, and even a mizen, top-sail, which will prevent her rolling so rapidly by their lofty situation; and as these sails are much above the sea, they are not likely to be becalmed by the waves.

If a ship is to be brought-to in those latitudes where a sudden shift of wind is expected, the course stay-sails are the best sails to lie-to-under, as then a vessel is in readiness for either tack, let the wind come as it may; and should one of these stay-sails be blown away, it will very little affect the ship.

## REMARK.

The top-sails are certainly superior to the courses for lying-to under, as they can be readily braced about, and are much easier to take in. If top-sails be used for this purpose, it will be found convenient to have a fourth reef, of such a depth as to admit the sail to be a taught leach, with the yard a foot or two off the cap; and as this part of the sail is intended for more boisterous weather than the rest, it must be made of stouter canvas.

*Upon a Floating-Anchor to ride a Vessel in a Gale of Wind.*

The fishermen in the North Sea, after they have driven from their anchors, make use of what they term, a drogue-sail to ride their vessels by; but this idea is much improved by Dr. Franklin, who has recommended a floating-anchor for that purpose, much in the shape of a kite, which is made to dive beneath the heave of the sea.

Such an anchor has long been wanting, and would be of material service to ships returning from India round the Cape of Good Hope, in which latitude it frequently happens that they

are

are under the necessity of lying-to for several weeks together.

*Construction of a Floating-Anchor.*

The two cross pieces **AB**, **CD**, fig. 11, plate 1, are two cross pieces of iron, in length nearly half the beam of the vessel the anchor is intended for, and united by a bolt through their centres, that they may be swung together when the anchor is not wanted. At the end of the cross pieces are holes for the rope **ADBC** to pass through, which must be hove extremely taught. To this frame is fitted a strong double canvass cloth of the same shape, which is laced taught out to the rope. At the centre of the frame **L** is a crow-foot of four legs, coming from the cross pieces on each side of the centre, which meet in a loop above the centre towards **B**, so that when the crow-foot is pulled upon, the anchor may incline to the water and dive down, the same as a kite rises in the air. At **A** is a ring, to which is bent the end of about 12 fathoms of rope, with a buoy at the other end, to prevent the anchor from diving lower than the length of the rope. When this anchor is to be used, let a hawser be bent to the crow-foot, and a small rope to the buoy; then put the anchor overboard, and veer away upon the rope and hawser to a sufficient quantity to ride

side the vessel, when it will have the appearance of fig. 12

To get the anchor on board again, haul upon the small rope, which will cause it to come flat to the surface of the water, in which position it may be easily drawn to the vessel. It will be necessary to have the mizen-stay-sail in readiness to hoist, to keep the ship to the wind till the anchor is hauled on board and placed away.

#### *Upon Reefing.*

Reefing smartly depends upon practice, and stationing the people to advantage. In blowing weather, taking in a reef is often attended with considerable time and labour, from not sufficiently spilling the sail. To get in a second and third reef, when blowing hard and sailing large, it will be necessary to clew up the sail, and brace it as much to the wind as possible; and to bring the ship to the wind in a small degree, if it can be done without hazard. Upon a wind, a second reef may generally be taken in without clewing up the sail, but a third reef seldom. If the sail be not clewed up, the officer should be careful to haul the buntlines well taught, to prevent the sails flying up and beating the people off the yard. In reefing a course, the points are generally crossed over the

the head of the sail and round the yard; as the purport of this does not appear material, and as it takes up much time, when expedition is required it had better be dispensed with.

*Upon Scudding before the Wind in a hard Gale.*

As the wind is perceived to increase, and a gale of wind is expected nearly in the direction of the course, from the appearance of the weather and the latitude of the ship, all expedition must be made to prepare the vessel for scudding before the wind and waves. Let the reefs be taken in, and the sails be furled in time. Let the top-gallant-yards and masts, mizen-top-sail yard, mizen-yard, and cross-jack-yard be got down upon deck, that the ship may be as snug as possible. Let preventer-braces be rove for the lower-yards, and let rolling tackles be hooked to all the yards, and bowed well taught.

Should the sea run extremely high, there must be no dread of carrying sail, to give the ship as much head-way as possible, lest the sea should strike the ship with violence abaft.

The best sails for scudding under are a reefed fore-sail, and double or close reefed main-top-sail; if these sails will stand the gale, there will be little danger of the masts.

As, in scudding, the safety of the ship depends upon good steerage, great care must be taken to have excellent helmsmen, a compass by the tiller, and careful people to attend the relieving tackles, as, either through want of experience in the helmsmen, or the breaking of a tiller-rope, the ship may be broached-to, and many ill consequences follow. The officer of the deck should be careful to have the fore-sheets and preventer-braces clear, with hands to attend them; for should the helmsman broach-to the ship by bringing the wind so much on either side as to touch the sails, the head-yards must be immediately braced up: and should the tiller-rope break with no relieving tackles hooked, or any accident happen to the tiller, the after-yards must be braced up, the fore-sail taken in, and the ship hove-to under the mizen-fay-sail while the mischief is repairing.

### *Upon Steering.*

As a compass suffers much agitation from the motion of a vessel, and does not return sufficiently quick to its parallelism to point out the absolute position of the vessel's head, good steerage requires further assistance, which depending upon a quick sight and nice judgment, is the reason we meet so few good helmsmen.

The

The helmsman must not pore over the compass, but alternately watch the compass, and the motion of the vessel's head passing the clouds, the sea, or any other objects more fixed than the compass, which may happen to present themselves to view. In blowing weather, if one person can manage the helm, the feel of it in his hand is a nice criterion of judging whether the vessel be coming-to or falling-off; so also is the greater or less noise or whistling of the wind. As the vessel comes-to against the helm, it will feel heavier; and the wind coming more forward will appear stronger: on the contrary, as she goes off and gives way to the power of the helm, it eases in the hand; and by the wind's drawing aft, it appears to lessen. These circumstances, to an attentive and nice observer, mark the motion of the vessel sooner than the compass.

*Upon Veering under a Main-sail and Fore-stay-sail  
in a Gale of Wind.*

To veer under a main-sail and fore-stay-sail in a gale of wind, watch the ship's falling off, then put the helm aweather, ease off handsomely the main-sheet, and gather forward the lee-main-tack. The wind abaft the beam, let go the main-bow-line, and round in the weather-main-brace.

The wind aft, haul down the fore-stay-sail, square the head yards, brace up the after-yards, and haul on board the main-tack. The wind upon the quarter, set the mizen-stay-sail, and haul aft the main-sheet. Be careful now to moderate the ship's coming-to, for should she meet a powerful sea with considerable head-way, it may prove extremely destructive. The ship to the wind, haul up the main-bow-line.

## REMARKS,

The reason for not squaring the main-yard till the wind is abaft the beam is, that the weather part of the main-sail, when the yard is braced up, being situated before the centre of gravity, acts with considerable force to pay off the ship's head. For making the weather part of the sail of greater service, the following method is sometimes practised: bend the end of a stout rope to the lings of the main-yard, then lead it down before the main-sail to the top-sail-sheet-bits, and let it be hauled well taught and belayed; thus when the main-sheet is eased off, the weather-half of the sail will not lose any of its power to veer the ship. Let a hand stand by the rope to let it go when necessary.

In a very high sea it will be attended with danger to veer under a main-sail only, as by the

ship's falling off and not quickly gathering head-way, she is liable to be overtaken by the sea, which may break on board her with considerable violence. In this case the fore-top-sail should be set, which may be taken in when the wind is abaft, or, as convenient,

*Upon Checking a Ship round in a Tide's-way with  
a Kedge-Anchor and Hawser.*

The practice of checking a ship round in a tide's-way is more necessary in large ships, which are longer in performing their evolutions, than in small. For this purpose a boat with a kedge-anchor and crew should be in readiness to run out a hawser upon either bow, or quarter, as may be required. Let us suppose that a large ship is standing over to the shore under her top-sails, and it is thought there is not room for her to come round in before she will be on shore. In this case, hand the end of the hawser into the boat from the weather-quarter, bend it to the anchor, and pay down a good quantity into the boat; then put the ship in stays, and send the boat round the stern to let go the anchor. When the anchor is gone, take a turn with the hawser, and the tide will presently hustle the ship to windward; taughen the hawser and bring her about; then trip the anchor, unbend the hawser,

and haul it on board. Should it be required to veer the ship, let the hawser be handed into the boat from the weather-bow, and let the boat be pulled round the bow, and the anchor be dropped to leeward; thus the tide hustling the ship to windward, will taughen the hawser, and veer the ship round, bringing the wind upon the other quarter; then trip the anchor, and haul in the hawser.—It will be necessary to veer away the hawser as it taughens, to prevent its being broke by too sudden a check.

#### *Upon Drifting to Windward by the Tide.*

Where there is not sufficient room to work in a tide's-way, a ship is under the necessity of drifting, the art of which is to keep the ship in the fair-way, and at the same time to manœuvre the sails in such a manner as will least prevent the ship from driving.

If the wind is directly against the tide, and the channel is sufficiently broad, the ship should be drifted broadside to the wind, as the tide will then have the greatest power to drift her; and could the ship be backed astern, or shot ahead, at pleasure, she might be kept drifting upon the same tack with safety; but it happens, that ships will never back so far astern as they will shoot ahead. At the first of a stern-board a ship will

go

go briskly astern, but will soon fall off and drift, with the wind abaft the beam, forging ahead; for this reason she must be drifted with the helm alee. It follows, as a ship will shoot more ahead than she can be backed astern, that in time she will arrive at the opposite shore, when she must be stayed or veered, and drifted upon the other tack. If she is to be stayed, (which certainly has the preference, as less drift will be lost by it) let the sails be filled in time, to give the ship sufficient head-way to bring her about; then put the helm alee. Should she come about, the sails and helm, having now their proper position for a stern-board upon the other tack; need not be touched till her stern-way ceases, when the helm must be shifted alee, and the head-yards be squared to prevent her falling round off; but should the ship refuse stays, which is often the case\*, then

\* In a straight regular reach the tide runs strongest in the centre, and gradually diminishes till within a small distance of the shore, where the water is either slack or runs counter; of course, a vessel sailing across such a reach, upon a weather-tide, after having passed the middle of the reach, will have the tide stronger under her lee-quarter than lee-bow, which will very much impede, if not entirely prevent her coming about; and should her head have arrived in the eddy-water, while the tide yet continues to act under her lee-quarter, it is impossible she can stay. In irregular serpentine rivers, counter-tides and eddy-waters are met with at different distances from the shore: for want of proper attention to this circumstance, vessels are often run aground.

brace sharp round the head-yards, and box-haul her, by which method she will lose much less drift than by veering. If there is not room to give the vessel way to stay or veer her, she must be checked round as explained in page 51.

If the ship now drifting broadside is approaching a narrow channel where it would be dangerous drifting in this position, she must be veered and dropped stemming the tide. In this case, that the drift may be as much as possible, it will be necessary to take in sail, and reduce the ship's head-way till she has only steedage-way left; thus a vessel may be dropped through a fleet of ships at anchor, without danger. Should the wind be a little across the tide, a ship may be easily drifted in the fair-way, with her head towards the weather shore; for thus it will be found that she can be backed and filled at pleasure, and generally be drifted with the sails shivering, in which position they oppose least power to prevent the drift.

It frequently happens in serpentine rivers that the tide sets across; in this case the ship must be drifted with her head to the side from which the tide sets. These sets are readily discovered by observing the opening and shutting of two objects in the direction of the channel.

*Upon Kedging, or Drifting in calm Weather by the Tide.*

To drift a vessel by the tide in calm weather, a boat with a kedge-anchor and hawser must be in readiness to attend. The vessel is to be kept stemming the tide by the assistance of the boat ahead, and when it shall be required to check, or steer the ship to either side, drop the kedge, and gradually check the ship; thus, by the waters being made to pass her, the helm becomes of use to sheer her as required. It is necessary that smart hands be placed to veer away the hawser on board, lest by a sudden check it should be parted. When the ship has got a sufficient sheer, trip the anchor, and haul on board the hawser, which coil away in readiness to run out again. The London pilots are extremely expert at this manœuvre.

*Upon the manner of Kedging in the River Ganges, Bengal.*

In the River Ganges, where the tide is extremely strong, the pilots drift the largest vessels with a bower-anchor down. For this purpose, the cable is hove in short, and bitted: then to the cable before the bits is lashed one eye of the E 4 mes.

messenger, that the cable may be hove in at pleasure. Thus prepared, let the cable be shortened in till the ship drives at such a rate as to regulate her steerage, which rate may be preserved by heaving-in, or veering-away cable. But this mode of drifting is carried to a greater extent, when it is required to drift a ship a considerable distance obliquely to the stream. The cable being prepared as before, let two springs be fixed to the anchor, coming in upon each quarter. Then, by veering-away cable, and holding on the larboard spring till the tide be four points on the bow, she will drift in the direction AB, plate 2, fig. 1; and by holding on the starboard spring, she will drift in the direction AB, fig. 2. Again, should it be required to drift down with the greatest force, let her be given the position of fig. 3. By a judicious use of these positions, a vessel may be conducted with facility and safety.

#### *Upon Trimming the Sails.*

It is necessary all sails should be trimmed, to stand as taught as possible. The more a sail is made to approach a flat surface, either by or before the wind, the better: the notion that there should be a reef of slack canvass let out when sailing large is ridiculous. It is likewise necessary

necessary the sails should be so balanced fore and aft, that the helm may be carried amidships, for nothing can be more absurd than a ship's carrying a large driver booming over her taffrail with a turn and a half of weather helm. If the helm cannot be eased by setting head-sail, the driver should be taken in, when she will be more under command, and sail faster; for the force of the water against the rudder in the direction of the stern, is greater than the direct effort of the driver, which obliges it to be kept in that position; therefore by taking the driver in, and thus suffering the ship to carry her helm amidships, she certainly will sail with greater velocity. The sails that will most tend to counteract the driver, when the wind is abaft the beam, are the lower and top-mast-studding-sails set forward: these sails standing out considerably from the ship, act with a length of lever to pay off the ship's head.

It has been demonstrated that whatever angle the wind may make with a vessel's head, to gain the greatest velocity of sailing, this angle must be so divided by the yards that the tangent of the angle between the wind and the yards may be double the tangent of the angle formed by the yards and the vessel's head; though, this rule becomes useless to three-masted vessels when the wind is more than a point abaft the beam, for then

then the after-sails would obstruct the wind's filling the head-sails. But when the wind is upon or before the beam, if the yards be so braced that the angles between the wind and the yards may be a point and three quarters greater than the angles formed by the yards and the ship's head, then they will be trimmed nearly according to the foregoing demonstration. Though it may be difficult in practice to exactly follow this rule, yet always be careful that the absolute angles between the wind and the yards may be more open than the angles between the yards and the ship's head, that the sails may not be kept touching the wind.

If the wind is abaft the beam, the after-yards should be braced more up than the head-yards, that the wind may fill the head-sails.

#### REMARK.

The yards of a ship do not brace up sufficiently sharp to sail only six points from the wind with the greatest velocity, for in this case the yards should be braced up to make an angle with the ship's head of 25 degrees only, as was proved page 21, instead of which they generally make an angle of 35 degrees.

If the two foremost shrouds on each side were lashed, or woolded close into the mast, just above the trussparrels, and the shrouds gradually counter-pined

pin'd in, more forward than aft, the yards might be braced up to make a less angle with the keel. The bringing these shrouds lower upon the mast will not make it less secure; were ships to have a shroud on each side, to set up abreast of the mast, and placed midway to the mast between the catharpins and the deck, they would prove an excellent security, as, before a mast goes it must have a bend to windward, between the deck and the catharpins, in that part where it is about to give way; but with shrouds of this kind the bend would in a great measure be prevented by the lee-shroud.

*A Vane does not shew the absolute Direction of the Wind when sailing obliquely to it.*

On board a vessel sailing obliquely to the wind, a vane does not shew the absolute direction of the wind, but a direction compounded of the vessel's way and the velocity of the wind. By the vane, a ship will appear to be lying about four and a half, or five points from the wind; but if she is put about it will probably be found that the two courses differ by thirteen points, which shews that the ship was six and a half points from the wind, when by the vane it appeared to be about five.

*Upon the Action of the Jib and Stay-sails.*

As the action of a sail is perpendicular to its surface, the jib and most of the stay-sails must be rising-sails; therefore the jib instead of tending to make the ship pitch, on the contrary will prevent it.

*Upon the Position of the Masts.*

If the masts are upright, all the square-sails act horizontally, and while their centre of effort is the same height with the point velique, they will not tend to force the ship from her parallelism; but if the fore-mast is stayed forward, which is often a practice, the head-sails will depress the ship; and if the mizen-mast is stayed aft, the square-sails set upon it will rise the stern, and still more depress the bow. From which reasoning it appears that all masts should be erect, which certainly has a more beautiful appearance than to see one mast falling over the taffarel, and another tumbling over the bows.

*A Ship will not always sail the faster for more Sail.*

It does not always follow that a ship will sail the faster for setting more sail. For instance, let

us suppose that a ship in good trim is gliding along perfectly easy at as great a velocity as she is accustomed to sail with, and that the centre of effort of her sails meets the point velique. Now, after this, if another sail should be added, either above or below the point velique, the centre of effort will no longer meet it, and of course the trim of the ship will be altered for the worse: also, if the impeding of the ship's way, caused by a weather-helm, is more than the acceleration arising from the after-sails, which obliges the helm to be kept in that position, the ship would sail faster without these sails.

*Upon taking bad-sailing Vessels in Tow with the least Detention.*

In convoys, where it is found necessary to tow, it ought only to be practised when the wind is steady, and the water tolerably smooth, as the loss arising from taking in tow, breaking of hawsers, and probable mischief to each other, is more than will be otherwise compensated.

If the water be tolerably smooth, and the wind moderate, a vessel may be taken in tow without shortening sail or altering the course. For this purpose, let the tower situate herself half a cable, or more, ahead of the tow, adapting her sail to preserve that position; the tow at the same

same time just steering to windward of her wake. Thus situated, the tow is in readiness to receive under her lee either a buoy or boat, with a small rope to haul the hawser or tow-line on board. A boat is certainly preferable; if it can be hoisted in without detention; but should it blow fresh, the ships must haul the wind, and place themselves in the above position; thus they can reduce their head-way, and back and fill at pleasure. If the ship to be towed is disabled in her rigging, it may be found necessary to heave-to. If so, the tower must heave-to upon the weather-bow of the tow, otherwise, the hauling the tow-line on board will cause both ships to fall off from the wind before it be properly fast. The size of the tow-line should be adapted to the weather;—ships had better be asunder than tow with a heavy hawser in light winds. A small rope is sufficient at these times, being careful to haul or heave a larger on board as the breeze freshens, which can be done without detention.

#### *Upon Chasing to Windward.*

The best mode of chasing to windward is disputed; many seamen think it proper to tack when arrived in the wake of the chase. Theorists are of opinion, that, *to tack each time the chase bears abeam* has the advantage. Let us examine the case.

difference.

difference. If it be granted that there be no advantage or disadvantage gained by staying, a ship will ply as much to windward by sailing 10 miles on one tack, as by sailing the same distance on ten different boards, or any number of boards; therefore, whether the chaser tacks when in the wake of the chase, or when the chase is abeam, she must ever pass over the same distance to arrive at her, provided she keeps the wind. After having gained the wake of the chase, if the chaser tacks each time the masts of the chase are in one, she must follow in exactly the same track; but if the chaser tacks each time she brings the chase abeam, she will follow, during the pursuit, a track to leeward of the chase's track, but gradually approaching it till she joins her. Thus, let CDE, plate 2, fig. 4, represent the track of a chase; if the chaser A, upon discovering the chase C, stands towards B, till she arrives at the wake of C, then stands after her, following her wake, she will sail through the same track, till she joins her at E; but if the chaser tacks each time the chase is abeam, she will pass through the dotted track, to leeward of the other, till she joins her at E.

By the first method, after gaining the wake of the chase, no more tacks are made by the chaser than the chase; but by the second, a much greater number are made, which gradually become quicker

quicker and shorter. If the water be smooth, and the chaser works quick, keeping fresh head-way in stays, it will certainly be most advantageous to follow the last-mentioned plan; because she gains to windward in stays, and because, by plying close under the lee of the chase, she forces her to keep her wind, and prevents the possibility of an escape while day-light remains. The objections to the first method are, that, if the vessels be far distant, by A's standing to gain the wake of C, she would be removed too far to observe her motion; and when the wake is gained, she leaves the chase at liberty to bear up.

Upon summing up these facts, it may be concluded, that while the chaser works quick, to tack when the chase is abeam is preferable. But if it be found that tacking is disadvantageous, let tacking a beam be practised only till the chaser may stand for the wake of the chase, without too great a separation, but by no means stand beyond the wake; on the contrary, rather tack short of it, so as to have the chase, when on the same tack, open on the weather-bow.

#### *Upon Chasing to Leeward.*

To pursue a chase to leeward, the chaser must ever keep her at the same bearings. The reason of this will appear by the assistance of a figure

figure, plate 2, fig. 5. Suppose A, the chaser, discovers B, the chase, standing along the course BC; then let the course of A approach their line of bearings AB, by such a quantity, as will preserve B on the same point of the compass. When A has arrived at D, B continuing her first bearings, must have arrived at E; for the distance A.D, is to the sailing of the chaser, as BE is to the sailing of the chase; and if AD be continued till it cuts the course of the chase, the cutting-point will be their point of meeting, and shews the distance each must sail before they join; for the respective legs of the triangle AC and BC are proportional to the sailing of the two vessels: that is, by A's preserving B at the same bearings, they both pass through, at the same time, two legs of a triangle, which are each respectively proportional to their sailing.

Instead of shaping such a course as to preserve the chase at her original bearings; suppose the chaser (which is often done) should haul for the chase keeping her directly ahead throughout the pursuit, what will be the consequence?—that to arrive at her, she must sail through a much greater distance in a curved line (as represented by the dotted curve in the triangle) steering through all the different courses contained between the lines AB and AC.

*Observations for the Chase.*

If the chase be closely plied to windward, by the chaser continuing under her lee, she must not attempt to bear up, but continue her course to the utmost, in hopes of being favoured by night. Should the chaser tack in her wake, and be far distant, it is in the power of the chase to bear up, if it be thought beneficial; but this must be done in a slight degree only, for, if the chase bears up much, it will shorten the distance of the pursuit.

When it is discovered by a vessel to leeward that she is chased, (granting that she sails as well with respect to other vessels by the wind, as large) she must steer directly away, making her course opposite to the bearings of the chaser, as this course must prolong the pursuit more than any other.

If the chase be far to windward, she has little to fear, as a pursuit to windward is prolonged beyond one in a direct course of the same distance, by the difference of time required between sailing direct, and working to windward; this difference is about three to one.

**REMARKS**

**REMARKS**

When chasing, the bearings of the chase must be accurately observed with an azimuth compass. If the chase cannot be preserved at her first bearings, she sails better than the chaser.

**Upon Sailing against a Sea.**

Making sail against a head-sea is attended with considerable danger, particularly if the sea be short; thus when one sea has passed abeam a vessel's midships and depressed her head, she will be met by a second before her head has risen, which will shock and pass over her with a force expressed by the square of the united velocities of the ship and sea; therefore, by reducing the head-way, it will diminish the power of the waves. If this be accomplished by taking in the square-sails forward, it will also prevent her pitching so deep into the sea.

It is a custom when a sea is seen coming upon the bow to put the helm down, and thus cause the ship to meet it. This practice, I should imagine, must have arisen from its relieving the person who is steering from the weight of the helm, which is greater as the sea passes aft and strikes the rudder; for it is attended

with the expressions, “*Ease her, ease her!*” but it does not appear that the pitching is in the least prevented: the helmsman being eased of his burden, it is concluded the ship suffers a general relief. However, it has the advantage of easing the rudder, from the sudden jerk of the sea, and prevents the ship being thrown off from her course; but if a towering sea is observed coming upon the beam, it would be the height of imprudence to put the helm down; rather put it up, and thus diminish the force of the wave by running from it.

We cannot conclude this chapter, without particularly advising the practice of keeping the people to fixed stations. By frequent custom, the evolution becomes familiar. Therefore, let station-lists be made out for the principal manœuvres, as “tacking, veering, furling sails, reefing, and heaving up the anchor.”

CHAP.

When a ship is coming to an anchor, she should always be under easy sail, as, the top-sails, jib, and fore-stay-sail, mizen, and mizen-stay-sail.

### C H A P. III.

#### UPON COMING TO AN ANCHOR.

When a ship is coming to an anchor, she should always be under easy sail, as, the top-sails, jib, and fore-stay-sail, mizen, and mizen-stay-sail.

**WHEN** a ship is coming to an anchor, she should always be under easy sail, as, the top-sails, jib, and fore-stay-sail, mizen, and mizen-stay-sail.

**To bring a Ship to an Anchor with a Side-wind where there is no Current.**

To bring a ship to an anchor with a side-wind where there is no current, let the sail be reduced to the top-sail; and when she shall be within a few ships' length to leeward of her anchoring-birth, put the helm alee, haul down the jib and fore-stay-sail, clew up the fore and main-top-sail, and throw the mizen-top-sail sharp aback to the mast. When she has stern-way, let go the anchor, right the helm, and give the ship the necessary cable; then send the hands up to farr the sails.—Thus, suppose a ship sailing with a side-wind, in the direction of AB, plate 2, fig. 6, and that C is the birth fixed upon to anchor her; when arrived at B, a certain distance to leeward of C, let her be brought to the wind, and if the

point B has been well established, the ship will perform the curve BC; when, let go the anchor.

*To come to an Anchor with the Wind aft, where there is no Current.*

When coming to an anchor, with the wind aft, where there is no current, if the ship has fresh head-way, it will be proper to take in the main-top-sail while the ship is yet in the offing. The anchoring-birth being fixed upon, steer the ship to a small distance on one side of it: when nearly abreast of the anchoring-birth, put the helm hard over, haul out the mizen, and haul aft the mizen stay-sail sheet, to luff the ship smartly to her situation; clew the fore-top-sail up when it shakes, brace sharp aback the mizen-top-sail, and let go the anchor when the ship has stern-way.

For instance, suppose a ship sailing into a road-stead in the direction of DA, plate 2, fig. 2, with the wind aft, and that C is the place fixed upon to anchor her; when arrived at the point A, let her be brought to the wind; and if the distance of the point A from C be well judged, the ship will perform the curve ABC, just reaching her birth.

*REMARKS.*

Should it blow hard, the ship must be made as snug as possible while in the offing. All sails

that can be spared should be furled; and top-gallant-yards got down. Both the bower cables must be ranged, or the best bower and sheet, and great care taken that every thing be clear about the anchors.

In seeking out an anchoring-birth, attention is to be paid to the buoys of the ships at anchor, lest their cables be over-laid.

*To come to an Anchor without Tending.*

It sometimes happens that a ship is to be brought up in a place where there is not sufficient room to tend her. In this case reduce her head-way as much as possible, before she comes to her anchoring-birth.

*To come to an Anchor upon a Weather-Tide.*

To come to an anchor upon a weather-tide, the ship should be so steered as to be brought to her birth stemming the tide, and shot ahead of her anchor.

*To come to an Anchor upon a Lee-Tide.*

To come to an anchor upon a lee-tide, the ship must be brought to her situation, if possible, upon that tack which will most admit her head

stemming the tide, in order to bring up with greater ease. Should it blow hard, and the tide be strong, the square-sails had better be furled while the ship is yet in the offing, and the ship be run into her anchoring-birth under the stay-sails. When the ship is arrived at her intended situation, put the helm alee, haul down the fore-stay-sail, and set the mizen and mizen-stay-sail, to bring the ship rapidly to the wind; then let go the anchor, before she loses her way and falls off from the wind.

Upon this occasion, both bower-cables, or best bower and sheet, should be ranged and bitted, in case of parting. If the first cable be not thought good enough to bring the ship up, when about a third of it is out, let go the second anchor, and veer away upon both cables. This anchor must be hove up before the ship tends for the weather-tide.

When a ship is expected to bring up extremely hard, it is an excellent plan to range the cable, and bit it to the foremost bits, then to haul up a second range, and bit it to the after-bits, that the cable thus doubly bitted may be wore away with ease: this mode of biting is represented in plate 2, fig. 8. Great care must be taken that the after part of the second range be abaft the after part of the first.

*To let go all the Anchors to the best Advantage.*

When it is found that a ship cannot clear the shore under her lee by sailing, owing to the strength of the wind and the height of the sea, the last resource is to come to an anchor with all the anchors in the best position. For this purpose, let the cables that are bent be got clear for running. Then furl all the square sails with as much expedition as possible, and shoot the ship along the shore under the stay-sails. When the square-sails are furled, let go the weathermost anchor, and veer away briskly the cable; then let go the next weathermost, and so on, till all the anchors are gone, nearly in a line along the shore; thus when the ship becomes wind-rode, all the cables may be made to bear an equal strain, and are separated from each other.

## C H A P. IV.

## Of KEEPING A CLEAR ANCHOR.

THE art of keeping a clear anchor is thought to be a difficult branch of seamanship, but I believe only from its being so seldom practised by the generality of seamen, particularly by those who sail long voyages; those seamen not being often in a tide's-way at single anchor without having a pilot on board, whose duty is to tend the ship at high and low water.

*Upon the Nature of Sheering a Vessel to one Side of her Anchor.*

If the side of a ship at anchor is presented to the tide by any means, the water will act upon her two ways, one in the direction of her keel, the other in the direction of her beam, which last will cause her to sheer out to one side of her anchor, which before was ahead. Suppose, for example, the power that presents the ship's side to the tide was a spring from the anchor coming in aft on the starboard side; upon heaving in the spring, the ship will sheer over to port, bringing

bringing the anchor upon the starboard bow. The more the spring is hove in, the more the ship will go ahead and over to port, till her side makes an angle with the tide of 45 degrees, when she will be the farthest over from her anchor that she can go; and if the spring is hove in after this, the ship will return, and be in the stream of her anchor when she is hove round broadside to the tide. Now if the helm is put over to starboard, it will act the part of the spring, by forcing the ship's stern to starboard, and thus by causing the water to act upon her starboard side, the ship will be forced over to port: and if the helm had been put aport, the larboard side would be presented to the action of the water, and the ship would go over to starboard: but the power of the rudder being according to the strength of the tide, which strength lessens upon the rudder as the ship sheers obliquely to the stream, it can never produce so great an effect as the spring.

## REMARKS.

It should be a practice to shoot a ship, if it can possibly be done, on the same side of her anchor at each change of tide, that the danger arising from the anchor's not turning as the ship swings may be avoided; for should the anchor not turn in the ground, the cable will get foul about

about the upper fluke or stock, and either trip it out of the ground, or damage the cable. It often happens, when an anchor is tripped out of stiff ground, that it will not take hold a second time without the upper fluke should cant down; for the quantity of clay that adheres to the fluke prevents its digging into the ground afresh; so the anchor keeps tripping over the surface, and another anchor must be let go before the ship can be brought up.

As a ship by being sheered presents one bow to the tide, if the wind is directly against the tide, it must blow upon the opposite quarter.

To tend a Ship for a Weather-Tide.

Let us suppose a ship riding at single anchor, upon a lee-tide, with the wind in the direction of the tide, and that it is required, upon the tide's setting to windward, to tend the ship clear of her anchor. For this purpose, when the weather-tide sets, and brings the wind broad upon either bow, hoist the jib and fore-stay-sail with the sheets aft; and if there is little wind, brace full the yards, and set the main-top-mast-stay-sail to shoot the ship a taught cable from her anchor. Now put the helm alee, and wait till the tide settles the ship over to windward of her cable.

the buoy coming upon the same side that the helm is put over to; after which, should the wind blow so fresh as to shoot the ship end-on with the cable, brace to the head-yard, and keep the after-yards full to assist the helm. If from little wind the buoy bears nearly abeam, the jib and fore-stay-sail may be hauled down; but if the wind blows fresh, and shoots the ship nearly end-on with the cable, bringing the buoy upon the quarter, it will be necessary to keep the fore-stay-sail up, as in this situation the ship will be in danger of breaking her sheer against the helm, and the fore-stay-sail will be in readiness to catch her before she can fall to windward of her anchor. As the weather-tide slackens, the ship will gradually fall wind-ward, when haul down the fore-stay-sail and right the helm; and should it blow fresh, let the yards be braced forward, and the ship be given the necessary cable.

*To Tend a Ship with the Wind a few Points across the Tide.*

Let us suppose a ship, riding lee-tide with the wind two or three points upon the bow, is to be swung for a weather-tide. When the lee-tide

\* Riding end-on with the cable, and the wind aft, is termed *Riding-staff.*

is

is done the ship will become wind-rode, of course must swing with her head to the weather-shore. As the tide makes to windward and brings the wind broad upon either side, hoist the jib and fore-stay-sail with the sheets aft, to shoot the ship a taught cable from her anchor. If there is little wind, let her be assisted by the main-top-mast and mizen-stay-sails, and filling the yards. When the tide has set the ship over to windward of her cable and thus brought the buoy upon the lee-side, put the helm a-lee, haul down the jib and fore-stay sail, and if it blows fresh, brace to the head-yards and fill the after-yards, in which position she will lay quiet the remainder of the tide. As the weather-tide slacks, the ship will shoot end-on with the cable, and gradually fall wind-rode, when, should it blow fresh, let her be given the necessary cable before the lee-tide makes strong, and the yards be pointed to the wind.

#### *To Tend a Ship with the Wind across the Tide.*

When the wind is across the tide, the simplest method of tending a ship is to keep her both tides to leeward of her anchor. At each slack water the ship will become wind-rode, and as she tends, and brings the wind on either side, put the helm aweather, and hoist the fore-stay-sail with

with the sheets to windward, to force the ship a taught cable from her anchor. When the tide is set, and the ship upon a proper steer to leeward of her anchor, the fore-stay-sail may be hauled down.

*Of keeping a clear Anchor in Calm Weather.*

In calm weather, when assistance cannot be given to a ship by sail to keep the cable clear of her anchor, but she is in danger of falling over it, or on the wrong side; then, as the tide flacks, let the cable be shortened in, easing the helm as the ship comes to the anchor.

*Demonstration of the preceding Rules.*

By the assistance of fig. 9, plate 2, the reason of the preceding rules will appear clear. Suppose the ship A riding lee-tide: when the tide sets to windward in the direction AG, it will carry the ship either one way or the other, say to the position of B; and should she be suffered to lay in this situation, it is possible she might fall over the anchor: therefore, to prevent it, hoist the jib and fore-stay-sail, and fill the yards, as shewn in the figure, and she will gradually shoot over and fall to windward by the tide to the position C, her stern coming to the wind by the tide's acting

ing upon her larboard side; and by putting the helm alee, the tide will be preserved on the larboard side, which will oblige the ship to pass over her cable, bringing the buoy upon the lee-side; and by bracing-to the head-yards, filling the after-yards, and setting the mizen and mizen-stay-sail, they will contribute to continue this position.

Should it blow fresh, it is readily conceived the ship must shoot to the position of D; or should it lessen, that she will gradually fall with a taught cable to the positions E or F, according to the strength of the wind compared with the tide. While the vessel remains with a sheer in the position of D, she cannot come near her anchor at slack water, for she is immediately to leeward of it, and will fall wind-rode to the position A without trouble; but if the vessel be in the position F, to windward of her anchor, she must be shot with a taught cable towards E and D, when she will gradually fall wind-rode as the tide slacks. Should there not be sufficient wind to shoot the ship from the position F, as the tide slacks, the cable must be hove in till it is up and down, gradually easing the helm as she comes to the anchor.

If the ship riding in the position of D break her sheer and come athwart the tide, bringing the wind upon her beam, she is liable to be driven over her anchor by the strength of the tide acting

ing on her lee-side. If, therefore, the fore-stay-sail be kept up, it will catch the ship upon thwarting the tide, and veer her to her situation before she can have dropped to windward over the anchor.

Again, suppose the wind across the tide in the direction AB, plate 2, fig. 10, at slack water; the vessel must be to leeward of her anchor in the position B, by the strength of the wind: as the tide makes from either C or D, she will swing to the position of E or F, and may, with the helm aweather, assisted by the fore-stay-sail, be kept taught to leeward of her anchor A, without a possibility of coming near it.

## REMARKS.

It should be remembered that, to sheer a vessel, it is not always necessary to put the helm hard over, (for by this means, in a strong tide, she may be sheer'd adrift) but adapt the helm to circumstances.

It will not be always necessary to make use of the yards in tending a ship to shoot her a taught cable from her anchor. In general, the jib, fore-stay-sail, and main-top-mast-stay-sail will be quite sufficient for this purpose.

G

Should

Should the wind shift at any time, it will be necessary to alter the sheer of the vessel accordingly.

If there is the least suspicion of the ship's having come near her anchor, it should be fished the first opportunity.

There are roadsteads where an anchor will so completely bury itself, that the bight of the cable can never foul it. In such places it would be better, should there be room, to lay a single anchor than to moor.

*At single Anchor, when to let go a second Anchor.*

In a tide's-way, at single anchor, a second anchor should never be let go, but when absolutely necessary; for with a long scope of cable, a ship will ride more easily than with a shorter scope upon two cables. Further, should a vessel happen to drift athwart hawse in a gale of wind, there will be only one cable to cut: but how dreadful is the situation of that vessel which has cut from two anchors, and probably not another remaining at her bow!

If your ship should be in the hawse of another, it will then be necessary to drop a second anchor under foot.

REMARK.

S A R D

## REMARK.

When riding in a gale of wind, the deep sea-lead should be kept overboard, and often attended, that the officer may be assured the ship rides fast.

*Upon Veering away Cable in a Gale of Wind.*

Veering away cable in a gale of wind requires great precaution. Should it fortunately be bitten, as represented plate 2, fig. 8, the cable may be wore away with considerable ease; but if not, before the stoppers are taken off, let the cable be put over the bit-head; thus, when the stoppers are taken off, and the cable unright about the bits, it will have the appearance, as represented plate 2, fig. 11, and may be wore away with as much ease as by biting the cable to both bits.

The general defect of bits is their not being sufficiently large, and the bit-head is too short, to admit a splice going round clear of the crow when the cable is bitten, as represented by fig.

## C H A P. V.

**UPON MOORING, &c.**

It should be a rule to moor in a road-stead with the best cable and anchor to that quarter where the strongest wind and the highest sea are expected from; but in rivers, or in a tide's-way, where freshes are expected, the best anchor and cable should be layed to the ebb.

*To Moor in a Tide's-way.*

Let us suppose a ship is about to be brought up at high water, and it is intended to moor with the best bower to the ebb. In that case, she should be brought up with the best bower, and the cable stoppered till the ebb makes strong; then veer away two cables, and, if it can be done, assist her astern with the mizen-top-sail. If, when the two cables are out, and the ship in the stream of her anchor, it is thought when moored she will ride too near any particular vessel, sheer her over from that vessel, and let go the small bower anchor. Now ship the capstan bars; bring to the best bower; veer away the

small

small bower; and heave in the best bower to the whole cable service; then stopper the cables and bit them, remembering to leave sufficient service within board to freshen hawse.

~~using one of swivel usage as dire room of  
the cables to elongate in the service to  
To Moor with a Swivel, half a Cable each Way.~~

To moor with a swivel half a cable each way, hang the swivel over the bows and bend to it the cable which is intended for the long bridle from the outer hawse-hole. The first anchor being let go, veer away to a half-cable, and lash the middle of the cable in the form of an eye, to which eye lash the swivel, and veer away upon both bridle and cable till the inner end of the cable can be got at to bend to the second anchor. The second anchor being let go, heave up to the swivel, and bend a short bridle from the other side of the stem, to guy the swivel amidships of the hawse. It will be necessary to have a good buoy-rope to one of the anchors, to unmoor with: — this had better be slightly stopped along the cable, so that its end may be got at by under-running the cable, which will put it out of the way of being stolen.

*To Moor with an open Hawse to any particular Quarter.*

To moor with an open hawse to any particular quarter, let us suppose, for example, the road-head, or river that the ship is to be moored in, to lie north and south, (in which direction the anchors are to be laid) that she carries her best bower on the larboard side, and it be requested that when moored, the ship shall have an open hawse with her head to the eastward. In this case the best bower must be the northern anchor. But if the hawse had been required to be open where her head was swung to the westward, the best bower must have been the southern anchor. This will appear clear by considering figure 12, plate 2, where N. E. S. W. represent the points of the compass.

*Of keeping a clear Hawse.*

When a ship is moored, many officers think themselves in so perfect a state of safety, or their minds are so much employed about the taking in or delivering the cargo, that the keeping the hawse clear is too much neglected.

If the hawse is clear, the ship must ever swing with her stern to the side the headmost cable leads

leads of : if she swings contrary to this, she will make a cross : if she swings a second time wrong, she will make an elbow ; and a third time, will make a round turn, in which situation it will be impossible either to heave in or veer away cable, let the case be ever so urgent.

If, to keep the hawse clear, the ship should swing with her stern to windward, it will be impracticable to get her the right way by any sail that can be set ; for as the tide slackens she will naturally fall wind-ward, and when the tide lets, it will take her upon the wrong side : however, if the wind continues, she cannot foul her hawse any more, as at the next tide the same wind will undo the cross it caused. When the wind is either ahead or astern, by the assistance of the mizen-top-sail or jib the ship can generally be made to swing the right way, provided the tide does not alter its direction as it ceases to run. For example, let us suppose the wind ahead, or even a little upon the starboard bow, and that the ship's stern is to swing to starboard :—in this case, set the mizen-top-sail with the starboard yard-arms braced forward ; haul up the starboard bow-line ; hoist the jib, with the sheet to windward ; and before the lee-tide is done, put the helm to starboard to give the ship a sheer, which will be preserved by the position of the sails. Now watch the tide, and at slack water

shift the helm: thus when the tide makes, it will act against the larboard side of the rudder and stern, and very much assist to swing the ship the right way. Again, should the wind be astern and a little upon the wrong quarter, if the helm be attended as before directed, and the mizen-top-sail braced full the right way, in all probability the ship will swing as required.

However, should this attending to the sails break the people too much off from their necessary harbour duty, if the helm only was properly regarded, it would often save the labour of clearing the hawse.

#### REMARK.

It will be proper at all times to have a rope and small anchor in readiness abaft, to run out and haul the ship round in calm weather.

#### *Upon clearing Hawse.*

Clearing hawse can seldom be attempted when the ship does not ride by the clearing table. To execute it, bend a fish-hook to a rope prepared from the bow-sprit-end. Now hook the cable the ship is riding by, below the turns in the hawse, and bowse it well up out of the water; then lash the cables together at the lower part of the turns. If the cable by which the hawse

is to be cleared leads on the starboard side, send the larboard fore or fore-top bow-line into the hawse-hole under the cable; or under and over, according as the cable to clear with is either below or above the other, which must be bent about three fathom within the hawse. Then send in the starboard bow-line, which let be bent well in towards the end of the cable, and stopped along the cable at about every fathom; and let a hawse rope be bent to the end of the cable. When all the bowlines are fast, unbit the cable, and haul out upon the starboard bowline; let a hand cut the stops as the cable comes out of the hawse; and when a long bight is out, haul upon the larboard bowline, and trice this bight up to the bowsprit. Should this one bight not sufficiently expend the cable, that its end may be taken round the other, hang it to the bowsprit, and send down the larboard bowline for a second bight. When the end of the cable is round the other, shift the hawse-rope and haul it in again. If the hawse is now clear, bit the cable and unlash, otherwise the end must go out again, and be passed round the cable the ship is riding by, till the hawse is perfectly clear.

## REMARKS,

Should it blow fresh, and the tide run to windward, it may prove dangerous trusting to the lashings.

lashings alone, lest the cable should run out end for end. In this case, bend a hawser with a rolling hitch to the clearing cable below the turns in the hawse, and let it be hove well taught as a double security.

If the weather is moderate, and the tide easy, the hawse may be readily cleared notwithstanding the ship is riding by the clearing cable. Thus bowse the clearing cable well up out of the water, and bend to it a hawser, from the hawse, below the turns. Then unbit the cable, veer away upon the hawser, and stick the headmost cable round the other till its end is clear; when, heave in upon the hawser, take in the cable again, and bit it.

*How to act when riding hard between the Cables.*

Should it come on to blow a gale of wind when a ship is moored, from that quarter which will oblige her to ride equally by each cable, and the hawse is clear, it will be necessary to splice a second cable to the small bower, and to veer away equally upon both cables; but should the hawse be foul, and it is expected that the cables will damage each other, then bend a hawser, below the turns in the hawse, to the small bower, which slip, and let the ship swing to the best bower. When the weather moderates,

heave in the end of the small bower, and the ship will be moored as before, with a clear hawse.

*To Unmoor a Ship.*

Suppose the ship to be unmoored had her best bower to the ebb, in that case let her be unmoored upon the ebb tide; but was there any necessity for unmooring upon the flood, the stream cable must be spliced to the small bower. To unmoor upon the ebb, when it has made strong, veer away the best bower, bring-to and heave in the small bower, and keep veering away the best, till the small bower is up and down; then stopper the best bower. The small bower up, cat the anchor, shift the messenger, bring-to the best bower, and heave in to the whole or half cable service, as may be thought necessary; then bit the cable, and fish the small bower anchor.

**REMARK.**

Should a ship be under the necessity of unmooring upon a windward tide with a strong wind, it will be extremely difficult and dangerous to take up the sternmost anchor. In this case, if there are no ships in the way, the headmost anchor may be taken up first with safety,

safety, and the sternmost cable be hove in towards slack water.

*To present a Ship's Side to an Object a-head, when either Wind or Tide-rode.*

To present a ship's side to an object a-head when either wind or tide-rode let a hawser be passed from aft, on the side that is to be shewn to the object, and bent to the headmost cable with a rolling hitch. Then by veering away the cable, and holding on the hawser, the ship's stern may be brought round to any required degree. The hawser in this case is called a spring; and it often happens that a spring on each side will be necessary to present either side to the object at pleasure.

## G H A P. VI.

**UPON GETTING UNDER WAY.**

To cast a Ship, riding Head to Wind, in a Place where there is no Tide.

To cast a ship, riding head to wind, in a place where there is no tide, let the cable be hove in short; send hands up to loose the top-sails, which let be sheeted home and hoisted; and if it is required to cast the ship upon the starboard tack, brace up the head-yards with the starboard braces, and the after-yards with the larboard braces; then put the helm to port, and send the hands to the capstern, to heave up briskly the anchor. When the anchor quits the ground, the ship, by the assistance of the helm and sails, will pay round to port; then hoist the jib and fore-stay-sail to help her. The anchor to the bow, fill the head-yards, keep the ship her course, and trim and make sail as required.

## REMARK.

Should the wind blow fresh, it will be proper to cast the anchor before the head-sails are filled.

*To cast a Ship when Tide-rode with the Wind  
abreast.*

To cast a ship when tide-rode with the wind ahead, the same practice must be followed with the *sails*, as to cast a ship when wind-rode and no current; but the *helm* must be put the contrary way, for now the effect of the *helm* is by the tide's passing her, which in the former case was by the ship's stern-way.

*Upon getting a Ship Under-way with a leading  
Wind in a Tide's-way,*

If the ship to be got under-way has a leading wind, and is in the midst of a number of vessels, or in a narrow channel, where it would be difficult to cast her upon the lee-tide, she should be got under-way before the weather-tide is done. Thus the casting of the ship will be avoided, and she may be steered through the channel or fleet with safety.

**REMARK.**

Should it blow so fresh upon the windward tide as to force the ship end-on with her cable, it will be impossible to heave it in without sheer-ing the ship over from side to side, and heaving

in

in briskly as the ship slacks the cable; but as this is attended with considerable danger, by the sudden bringing up of the ship upon each sheer, it will be prudent to heave apeak upon the first setting of the windward-tide, before the ship swings, to bring the wind aft.

*To cast a Ship from her Anchor, upon a Lee-side,  
and back her astern clear of Danger.*

To cast a ship from her anchor, upon a lee-side, and back her astern clear of danger, upon the starboard-tack, let the cable be hove in apeak; then set the three top-sails braced up with the starboard-braces, and put the helm to starboard. Now heave up the anchor, and as it quits the ground, by the effect of the helm the ship will cast, bringing the wind upon the starboard bow; and immediately she gets stern-way, the effect of the helm will be to keep her to the wind.

While the anchor is coming up from the bottom, the ship will keep to the wind, and back astern extremely well; and by the time the anchor is hove up to the bows, it may be supposed the ship has backed clear of the danger; when, shift the helm, run up the jib and fore-stay-sail, and shiver the after-sails. Thus the ship will

veer

veer round in little room; when, trim as required.

**REMARK.**

It must be remembered, that a ship will not readily veer till the anchor is close up to the bow; therefore, when a ship is to be got underway from deep water and a narrow channel, it is best to make a stern-board from her anchor, which will back her over to the shore astern by the time the anchor is up, and give her room to veer round.

**UPON SETTING AND TAKING IN SEVERAL  
SAILS IN BLOWING WEATHER.**

*To set a Main-Sail in a Gale of Wind.*

To set a main-sail in a gale of wind, before the sail is loosed, let the double block of a tackle be made fast to the weather-clew, and the single block be hooked low down upon the chaffree, and the fall led aft. Now, man well

the main-tack, and fall at the same time; and when the sail is loosed, ease away the weather-clew-garnet, let go the bunt-lines and leech-lines, bowse down upon the tackle, and take in the main-tack: the main-tack down, haul aft the sheet, brace up the yard, and haul the main-bow-line.

**REMARK.**

A fore-sail is set after the same manner as a main-sail; but as the fore-tacks generally lead double, they are a sufficient purchase without the aid of a tackle to the weather-clew.

*To set a Top-Sail, in a Gale of Wind.*

To set a top-sail, in a gale of wind, a tackle should always be in readiness to clap on either sheet, as may be required. First man the lee-sheet, and the sail being loosed, ease down the bunt-lines and lee clew-line, and haul home the lee-sheet; then haul home the weather-sheet, hoist the sail, and brace up as required.

**REMARK.**

Should the wind be quartering, the lower and top-sail yards should be braced well to the wind, before the sail is sheeted home.

*To take in a Course, in a Gale of Wind.*

To take in a course, in a gale of wind, man well the weather-clew-garnet, ease off the tack and bow-line, and run it up; then man the lee-clew-garnet, bunt-lines, leech-lines, and weather-brace, and being all ready, ease away the sheet, haul up the clew-garnet, bunt-lines, and leech-lines, and round in the weather-brace, till the yard is pointed to the wind. Now haul taught the trusses, braces, lifts, and rolling-tackle, and send the hands up to furl the sail.

*To take in a Top-Sail, in a Gale of Wind.*

Upon taking in a top-sail, in a gale of wind, nautical men are much divided; some approve clewing up to windward first, and others to lee-ward. If the weather-side is to be first clewed up, the weather-brace must be rounded well in, otherwise the lee-rigging will be in danger of being carried away by the great pressure of the lee-yard-arm. With the weather-brace well attended, this certainly is the most advantageous way of taking in a top-sail, for thus the sail may be taken in without a shake; but should the weather-brace give way, recourse must be had to clewing up to leeward first. When the sail is clewed

slewed up, bowse taught the rolling-tackle, and send the hands up to furl the sail.

*To take in a Jib, when blowing Fresh.*

To take in a jib, when blowing fresh, man well the down-haul, let go the haliards, ease off the sheet, and haul down briskly; and when the sail is close down, ease away the out-haul, and haul the sail in to the bow-sprit cap; then let it be stowed away in the fore-stay-sail netting.

*To baul in a Lower-studding-sail, blowing Fresh.*

To haul in a lower-studding-sail\*, blowing fresh, lead one of the sheets aft clear, and man it well; then lower away briskly the outer-haliards, to spill the sail; ease off the tack, run in upon the sheet, and lower away the inner-haliards, as required.

*To baul down a Top-mast Studding-sail, blowing Fresh.*

To haul down a top-mast studding-sail, blowing fresh, man well the deck-sheet and down-haul; ease off the yard-sheet, and haul the yard close out to the tack-block; then ease away the

\* The studding-sail is supposed to be set on a swinging boom.

tack, and haul down both upon the deck-sheet and down-haul.

*To brail up and haul down a Main-top-mast Stay-sail, blowing Fresh.*

To brail up and haul down a main-top-mast stay-sail, blowing fresh, man well the lee-brail and down-haul, having a few hands to gather in the slack of the weather-brail; then let go the haliards, ease off the sheet, and haul down and brail up as briskly as possible. When the sail is down, let go the tack, and stop the sail over to the lee fore-rigging.

*To brail up a Mizen, blowing Fresh.*

To brail up a mizen, blowing fresh, man well the lee-brails, particularly the throat-brails, which should have a whip purchase; ease off the mizen-sheet, and brail up briskly, taking in at the same time the slack of the weather-brails. After the sail is hauled up, stop its foot by passing the gasket round to leeward, which will spill it.

*To take in a Top-gallant-sail, blowing Fresh.*

To take in a top-gallant-sail, blowing fresh, the lee sheet must be started first; for if the weather-

weather-sheet is first eased off, the yard will fly fore and aft; *quoniam quod licet ediri exire non possit*  
*hinc abscissum hinc quoque non posse batur*  
*quoniam ex agitur.* *To bend a Course.*

To bend a course, stretch the sail athwart the deck, the starboard-side of the sail to the starboard side, the larboard to the larboard side; then bend yard-ropes to the earring-cringles, and make fast the head-earings a few feet up upon the yard-ropes. The bunt-lines, leech-lines, clew-garnets, and all the gear bent, make fast a rope-band to each bunt-line and leech-line leg, that the men may be enabled to catch the head of the sail from the yard. Now man well the yard-ropes, bunt-lines, leech-lines, and clew-garnets, and run the sail up to the yard. The sail aloft, send the hands up to bring it to; haul out the weather-earing first, then the lee; and if it is a new sail, ride the head-rope to stretch it. The sail being hauled square out upon the yard, make fast the rope-bands, keeping the head of the sail well upon the yard. Should it blow hard, it would be proper to reef the sail over the head, before it is sent aloft.

*To bend a Top-sail.*

*To bend a top-sail, overhaul the leeches of the sail, put in the earings, bend the bow line legs,*

legs, lay out the clews, and open them if necessary, and make the sail up snug again; then round down upon the lee-top-sail-haliards, till the weather fly-block is high enough to bring the sail up over the guard-iron; when, rack the tye over to the weather-top-mast-rigging. Now pile the sail up upon slings, with the lee-side uppermost; hook on the top-sail-haliards, and run the top-sail up into the top; then stretch the sail round the fore part of the top, bend the geer, and make fast the head earings a few feet up upon the reef-tackle-pendents, with a rope-band or two to each bunt-line leg. The geer being bent, man the reef-tackles, bunt-lines, and clew-lines, and haul out the sail. Let the hands lay out upon the yard, and haul out the weather-earing first; then haul out to leeward, and ease off to windward till the sail is square; when, make fast the rope-bands, keeping the head of the sail well up upon the yard.

*To unbend a Course, in a Gale of Wind.*

To unbend a course, in a gale of wind, first furl the sail, then cast off the rope-bands, and make them fast round the sail, clear of the gaskets. When the rope-bands are all off, ease off the lee-earing, and lower down the sail; and when the people upon deck have got hold of

the lee part of the sail, ease away the weather-earing.

*To unbend a Top-sail, in a Gale of Wind.*

To unbend a top-sail in a gale of wind, first cast off the points of the reefs, keeping fast the earings; then furl the sail, and cast off the rope-bands, which make fast round the sail, clear of the gaskets. After this cast off the lee-earings, and haul the lee side of the sail into the top; then haul in the weather side. Now unbend the reef-tackle pendants, bunt-lines, and bow-lines; bight the sail snugly up together; and send it down by the clew-lines to windward or leeward, as most convenient.

## C H A P. VIII.

**RESPECTING CABLES, NIPPERS, AND STOPPERS,**  
*Upon coiling Cables.*

ALL cables should be coiled the way they  
 bit, or the way they run round the windlass, and  
 their tiers should be on the side opposite to that  
 on which they lead. The best bower, which is  
 mostly the working cable, should lead foremost  
 up the hatchway; then the small bower; and  
 abaft all, the sheet, which being the least wanted  
 can be triced snug round the after part of the  
 hatchway, out of the way. Should your new  
 cables come immediately from the rope-walk,  
 let them be coiled down into the craft that is to  
 bring them on board, the same way they are to  
 be coiled on board.

A cable generally kinks from more turns  
 being forced into it by the coiling than it na-  
 turally had, and the only way to get rid of these  
 kinks, is to coil the cable across the hatchway  
 from side to side, in large fakes, with the sun;  
 then take the upper end through the coil, and  
 coil the cable down in the tier the way required.

By

By this means, as many turns will be taken out of the cable as there are fakes coiled round the hatchway.

It should be a rule in coiling cables never to lay out near the hatchway, but to keep that part of the tier as low as possible, that the bends may have sufficient room to upset.

Were all store cables first coiled down from the rope-walk against the sun, they would be better adapted to coil on either side of a ship; for a cable coiled against the sun will more easily reverse, and have less kinks in it than a cable coiled with the sun.

#### *On Splicing Cables.*

The snuggest and best method of splicing a cable is to put the ends in twice each way; then to pick out the strands, and worm part of them round the cable, and taper away the rest, which let be snugly marled down. After this let there be clapped on a good throat, and two end-seizings of six thread rattling.

The strands of the small bower and stream cable had better be pointed, that these cables may be more briskly spliced in case of necessity.

*Upon*

*Upon serving Cables.*

Cables should be served against the lay. The most expeditious way of clapping on rounding is with a top, when there is room to work it, otherwise, recourse must be had to beating it on with mallets. Be careful to let the service be stopped with spun-yarn every six or eight turns.

Mooring services are generally clapped on about fifteen fathoms from the end, or splice of the cable; and large vessels should have about twelve or fourteen fathoms of service, half of it rounding and plat, and the rest keeling. Upon the working cable, there should be a short service of eight or ten fathoms at the half cable.

Mats, made the width of the round of the cable, and about three fathoms long, are very convenient to have at hand, to lace on the cable with expedition in cases of necessity.

*Of an approved Dog-stopper.*

An approved form for a dog-stopper is to have it made with a large eye, that it may be thrown over the bit-head, and shifted over from side to side at pleasure.

*Of*

*Of an approved Bit-stopper.*

An approved form for a bit-stopper is to have it about four or five fathoms long, and tailed out, nipper fashion, at one end, and knotted at the other: let this stopper be rove through the hole in the knee before the bits. To pass it, let it be led aft, inside and over the cable, then under the bit-end, outside the cable, and worm its end round the cable before the bits, as represented by plate 2, figure 13. Now, to stopper the cable, haul taught the worming, and by the cable's drawing forward it will taughten the stopper, and bind the cable so close to the bits as effectually to bring the ship up. From the nature of this stopper it is not likely to jamb, therefore is extremely well calculated for bringing a ship up with ease, as by slacking or hauling taught the worming, the cable may be suffered to run out or be checked at pleasure.

In heaving up in a sea, when by a sudden pitch of the ship the messenger or nippers give way, this kind of stopper will be found extremely serviceable, for upon these occasions, it may be always passed ready, and the bight triced up abaft the bits with a rope-yarn, clear of the cable, as represented by plate 2, figure 14.

## REMARK.

## REMARK.

Stoppers from the wings of the tiers are extremely serviceable; but stoppers from the mast, below the combings, are of little service, unless they be made long enough to clap on above the combings.

*Upon Ring-Ropes.*

Ring-ropes are better single than double; for when single they are passed with less confusion of turns. To pass a single ring-rope, and have it in readiness to check upon veering away cable, take three slack turns through the ring, and round the cable, one before the other, and let a hand hold up the parts fair; then take as many slack turns of worming round the cable, before the ring, which let be held up fair by another hand, giving sufficient room for the cable to pass through. Now, when it is necessary to check the cable, haul taught the worming, and by the cable's going out it will presently draw those turns taught which were taken through the ring, and bind the cable so close to the ring, as to prove an excellent stopper.

*Upon*

( dog )

*Upon Nippers, and the Manner of clapping on a  
Racking Nipper.*

The usual method of clapping on a nipper, with a round turn round the messenger and another round the cable, is an exceeding good one, and very suitable to quick heaving; but when a strain is to be hove, and the cable is muddy, the nippers clapped on after this method will not bite, and recourse is generally had to hitching the messenger, a very bad practice, which justly deserves to be reprobated, as in the nip it materially damages both cable and messenger. In this case throw sand or ashes upon the cable, and take a long dry nipper, which middle and pass one half aft, racking it in and out round the cable and messenger; then worm its end round the messenger only. After this, pass the other half in the same manner forward, but worm its end round the cable only, and let a hand hold on each end of the nipper. Now the advantage of this method is, that by the cable's drawing forward, and the messenger aft, the nipper will be drawn so taught as effectually to hold the cable till something gives way: another advantage is, it can never jamb, for both ends are clear for taking off.

For quick heaving also, if nippers without knots are clapped on, as represented by figure 15, plate 2, where the nipper is taken once round the messenger and once round the cable, its foremost end being wormed round the cable, and the after-end round the messenger, it will save the cutting of many nippers.

## C H A P. IX.

### UPON PURCHASES, AND FRICTION.

IT is extremely necessary that every seaman should be so far acquainted with the mechanical powers, as to be able to calculate the force of those purchases he is continually applying.

### Upon the Crow, Handspec, and Capstern-bar.

The crow, handspec and capstern-bar are all levers of the same kind, differing only in their power by the difference of their lengths from each respective prop, or fulcrum.

Let us suppose AB, plate 1, fig. 13, to be a handspec or crow eleven feet long, and for the purpose of prising up a weight is rested upon the prop C at one foot from A, and the weight applied to the end A being ten hundred weight, it is required to know what power must be applied to the end of the handspec B to raise the weight at A. For this purpose, multiply the weight applied at A by the distance AC, and it will give the momentum of the weight. Now it is clear that the momentum on the other side of the prop must be made equal to this, before the weight at A can even be balanced, therefore let the distance CB be multiplied by some power that will make the momentum at B equal to the momentum at A, then that power will be the quantity necessary to raise the weight at A. For instance, in the present case, the weight at A of ten, multiplied by the distance AC of one, gives ten for the momentum at A; and if the distance CB of ten be multiplied by one it will give ten for the momentum at B; therefore one hundred must be the power applied at B to balance the weight at A; and to raise it higher, a little more power must be added to overcome the friction. Again, let us suppose AB to be a cap-stern-bar, and that the circle represents the barrel of a capstern turning on the centre C, which in this case is the prop. Now, if it is required

required to know what power at the end of the bar B will purchase the weight at A, we must apply the same reasoning as in the former case. For instance, let the weight be multiplied by half the diameter of the barrel, to give the momentum of the weight, which same momentum must be gained on the other side of the centre, by multiplying the distance BC by some power which will make the momentum on this side equal to the momentum on the other, which will be the power required.

Therefore, the power of a capstern or wind-las is nothing more than the united powers of a number of levers; but it must be remembered, that as capsterns turn round upon very large spindles; they are subject to a considerable degree of friction. This certainty may be remedied, either by decreasing the diameter of the spindle, or by fixing friction-rollers in the partners round the spindle, as represented by figure 16, plate 2, where A represents a section of the spindle, and the smaller circles the friction-rollers. But after taking off the extreme friction of a capstern, it will be found necessary to increase the number of paul-catches, to prevent the people being thrown from the bars when the ship pitches. larger circles on the ends, and small circles on the centre C Now, if it is the case in the ship, it is the case in the ship Upon setting

*Upon a Whip-Purchase.*

The better to conceive the power of a simple whip-purchase, let us ask the question—if a person was to haul a hundred weight into a ship's top by this means, which is represented by fig. 17, plate 2, what part of it would rest upon his hands? Let the block composing the whip be made fast to the weight, and let the standing part of the whip-fall be made fast to the top rim. Now, let the person in the top weigh the weight off the deck, and then let him consider what part of it rests upon his hands:—the weight hangs by two ropes which are equally taught, consequently each rope bears the same quantity of the weight, but together both ropes bear only a hundred weight; therefore each rope separately must bear fifty; and as the person holds one of the ropes, fifty weight must be the quantity resting upon his hands.

*Upon a Tackle.*

A tackle is a convenient kind of purchase, but subject to much friction. Its power will be, friction not considered, as the number of parts of the fall that are applied to sustain the weight. If the tackle consists of a double and a single block, there will be four parts of the fall; and if the weight to be hoisted up be hung to the

double block, it will rest upon four ropes, which are each equally stretched; therefore each must bear the same part of the weight. Now let us suppose the weight hung to the double block to be four hundred, then one hundred applied to the hauling part of the fall will suspend it; and if as much more power be applied as will overcome the friction, it will purchase the weight: but had the weight been hooked on to the single block, it would have rested by three ropes only, each of which would bear a third; therefore a third of the weight being applied to the hoisting part of the fall, would suspend the weight when hooked to the single block; and as much more power being applied as would overcome the friction of the tackle, would purchase the weight.

*Of the greatest Purchase to be gained by Blocks.*

The greatest purchase that can be gained by blocks, is by having a continued series of whips, that is, the continuation of fixing one whip upon another whip-fall. By this means, two single blocks will afford the same purchase as a tackle having a double and single block, and with considerably less friction. This kind of purchase should certainly be used whenever the length of the hoist will admit of it. To top-sail  
and

and top-gallant-yards that hoist up with a single tye, there will be sufficient room to apply this purchase as haliards, which will overhaul with great facility.

*Upon the Purchase gained by Swivelling off.*

What is called swivelling off, that is, pulling at right angles to a rope, is at first a very great power, but it decreases as the rope is pulled out of the straight line. This purchase depends upon the resolution of forces, and its power is as the sine of half the angle formed by the rope; that is, as half the angle A C B, fig. 14, plate 1.

A purchase upon this principle may be conveniently applied to several purposes. Thus, in the place of yard-tackles, let the blocks A and B, fig. 14, be fixed to the lower yard-arms, and through these blocks let there be rove a pendent with a hook at each end: the pendent should be long enough to reach the water on the opposite side, when one of the hooks are up at the yard-arm; for instance, with one hook up at B, the pendent should pass straight along the yard to A, and from A to the surface of the water. On the bight of the pendent let there be a fiddle-block, the pendent leading through the upper sheave, and a whip-purchase through the lower one, coming down before the mast amidships. Now,

when any thing is hoisting up by this purchase, for instance, the boat D, it will have the appearance as represented in the figure: if it be required to hoist in on the opposite side, overhaul down the hook B. It will be proper to have a tricing-line, to trice up the block C when the purchase is not wanted.

For an example of a second application of this purchase, let us suppose that a boat's crew were about to haul their boat ashore, but should find their own power insufficient, and that they had no tackle. In this case, let them drive down a stake well up from the water, and a second close down to the water's edge; then let the boat's painter be made fast to the upper stake straight from the boat, and led round the lower one; now, by swivelling off upon the painter midway between the stakes, the people will pull with much greater power; and if the power be yet insufficient, it is only moving the stakes further asunder.

#### *Upon Dead-eyes, Hearts, and Thimbles.*

The power gained by dead-eyes, hearts, and thimbles, is as the number of parts of the laniard that is rove through them; but if the laniard be not well greased, their power will be mostly, if not entirely, counterbalanced by the friction

friction they are subject to. This being the case, they are never applied as purchases, but merely for the better keeping the quantity gained of any shroud or stay when set up. For if a shroud or stay were set up without their application, the quantity lost upon making fast would slacken the shroud by the same quantity; but when a dead-eye and laniard are fixed to the shroud, should even six inches of the laniard be lost upon making fast, the shroud would be slackened only one inch; for there are six parts of the laniard to the shroud, and as the shroud is equally held by each part, it can only be slackened by the quantity that the parts of the laniard are lengthened.

*A general Rule for calculating the Power of Purchases.*

A general proportion for calculating the power of any particular engine is, as the weight is to its space passed through, so the space passed through by the power is to the power: thus, suppose that a weight when hoisting up by a tackle should pass through one foot for every three feet hoist of the fall, then the power will be as one to three; and if the end of a handspike should pass through ten inches to prize up a weight one, the power will be as one to ten.

*A Mechanical Increase of Power is Loss of Time.*

To shew that a mechanical increase of power is a loss of time, let us suppose that a person had to haul a hundred weight into a ship's top by a single rope, which is no purchase, then the length of the rope to pass through his hand would be equal to the height of the top from the deck; but if this person had to haul up the hundred weight by a whip-purchase, as represented by fig. 17, plate 2, then the length of the rope to pass through his hand would be equal to twice the height of the top from the deck; and admitting that the rope passed through the person's hands as fast in one case as the other, the weight would come up by the single rope in half the time that it would by the whip; which proves that an increase of power is loss of time.

*Upon Friction.*

The friction of most mechanical engines is so extremely compounded, as to make it difficult to say what is the precise quantity. Those metals will run the easiest together whose surfaces least adhere to each other; and it is supposed that the difference between the friction of two bodies, composed of similar substances, and moving

moving upon the same surface at the same rate, will be, as the difference of the surface pressed upon, and the pressure; also, that the friction of the same body increases as the squares of its velocity: therefore, the pins of blocks and spindles of every kind should be as small as safety will allow; and sheaves should be large, and falls be slack laid, otherwise much of the power will be lost in obliging the fall to bend to the sheave. All fixed blocks are only for the convenience of turning the direction of a fall; they add nothing to the power of the purchase, but on the contrary destroy so much as is necessary to overcome their friction, therefore these blocks are to be avoided as much as possible.

## C H A P. X.

## U P O N L E A K S .

WATER presses as the square roots of its altitude, that is, suppose equal holes be made in the bottom of a vessel at one foot, four feet, nine feet, and sixteen feet beneath the surface of the water, the water will rush in at these holes with a velocity equal to the square roots of their respective depths: for instance, at the four feet hole it will rush in twice as fast as at the one; at the nine feet, three times as fast; and at the sixteen feet, four times as fast; which is the law it will follow, provided the water be pumped out of the vessel as fast as it comes in. But if the water is suffered to rise in the vessel and cover any of the holes, the covered holes will then run with the same velocity, regardless of their depths, which velocity will be as the square root of the difference of the level between the water within and without the vessel; for example, let it be presumed, that the hole at sixteen feet was quite at the bottom of the vessel, and that the water had risen in her twelve feet, then as its surface is even with the four feet hole, the two covered holes

holes will run with the velocity only of the four feet hole, since four feet is the difference between the level of the water within and without the vessel.

From the foregoing reasoning it appears, that if a ship springs a leak under her bottom, though the water should increase upon the pumps at first, yet after the water has risen a certain height above the leak, the pumps will then be enabled to prevent it from rising higher.

Let us now consider how a leak in a vessel's bow and stern will be effected by her motion through the water. Let the leaks to be considered be of equal size, and nine feet deep, then the water will rush in at each leak with a velocity that may be expressed by three, while the ship is without motion and in still water; but if the vessel be given head-way, the water will increase running in at the bow by the head-way, and decrease at the stern in the same proportion: and should she sail so fast as to double the running in of the water at the bow, the leak at the stern will become nothing. Thus it appears, that a leak at the bow is more dangerous than a leak at the stern. A leak also on the lee-side must be more dangerous than a leak on the weather side; first, by its being forced deeper under water, and secondly, increased by the lee-way.

The

The following rules, founded upon the foregoing reasoning, may lead to a discovery of the situation of a single leak. First, if the ship increases making water as she sails, the leak is in the bow; but, on the contrary, if she decreases making water as she sails, the leak is in the stern; and, secondly, when sailing before the wind, if the ship makes neither more nor less water, the leak is on either side, which side may be discovered by hauling upon a wind; then if the ship makes more water it is on the lee-side, otherwise it is on the weather-side. It has been asserted, that by following round a leaky vessel in a calm with a pole, keeping one end applied to the ear, and the other to the vessel's bottom, that, should the end of the pole chance to pass near the leak, a rumbling noise will be heard coming up the pole, and thus point out its place.

Should a leak be in the bow, it certainly may, in a great measure, be remedied at sea by spreading a tarred sail with oakum sewed to it across the bows, and confining it to by ropes; then the motion of the vessel forward will press the sail close to the bow, and prevent the water from entering the leak. To a leak in any other part, the sail may not prove so effectual a remedy.

For preventing the water from entering the seams between wind and water, which some vessels

sels by their working are continually emptying of the oakum, it will be better to nail double canvass, or leather with oakum beneath it along the seams, than to cover them with lead, which is subject to be broken.

It has frequently happened that ships have been left by their crews, because the water gained upon the pumps, and that the same vessels have been met with afterwards and brought into port. If a ship's cargo, when soaked in water, would of itself float, there would be no danger of the ship's sinking, for as the water rose in the hold, the cargo immersed would become of no weight, but, on the contrary, would act as a support to the vessel by as much as it is lighter than water. Thus, a ship loaded with timber, though the water should be up to her decks, would not sink; and, probably, a ship loaded with spirits would not sink lower, after the whole cargo was immersed. Therefore, a commander, knowing that his cargo when soaked in water will float, should be very backward in deserting his vessel, for he may yet find more safety on board her than in open boats.

The danger to be expected on board a vessel in this situation is, she may upset; for as the cargo immersed bears less upon the vessel, her stability must proportionably decrease; and should the immersed part of the cargo, beneath

the centre of motion, consist of articles of the same weight, or specifically lighter than water, without iron or leaden-ballast in her bottom to keep her erect, she must inevitably turn bottom up. The criterion to judge of a vessel's stability in this situation is her roll, which becomes greater and flower as her stability lessens. Upon occasions of this kind, I would recommend the getting all heavy materials of every description, as lead, guns, and iron, as low into the hold as possible, and to throw overboard every article above the orlop deck, except the necessary conveniences of life; also to stanchion and lash the decks together round the beams, that they may sustain each other, and prevent their being blown up; and to bring up all empty casks, and secure them down to the orlop-deck beams. Thus prepared, the ship may have sufficient stability while in the act of sinking, and upon the empty casks being immersed, (since they are above the centre of motion) they will not only tend to float her, but add to her stability. After the casks are immersed, every attempt is to be made to prevent the water from rising higher; if this cannot be effected, the vessel must be quitted.

C H A P.

## C H A P. XI.

It has been before remarked, that the easiness of a vessel depends upon the situation of her centre of gravity. Should the cargo be heavy, and its centre of gravity be low, her stability will be so great as to return the vessel to her erect position with such violence, as to endanger the masts. Probably, a tolerable point for placing the centre of gravity of a vessel's cargo, if she is to be deeply laden, may be about half way between the kelson and centre of motion, which will be about a quarter of her beam up the hold. But if she is not to be deeply laden, the centre of gravity must be placed lower, otherwise the vessel will not have sufficient stability.

It is necessary likewise, for the purpose of relieving the pitching, and that the extremes of a vessel may not be loaded beyond their capacity to bear, that the weight be collected towards the centre of the vessel, between the main-mast and fore-hatchway, and that the extremes be loaded with the lightest articles: this is a circumstance too little attended to, particularly in East-India-

men,

men, where the water and provisions are stowed close forward.

If the cargo is regular, i. e. consists uniformly of the same goods, let it be stowed fore and aft upon a level, observing not to fill up the breakages, either forward or aft, with heavy articles.

If the cargo should be irregular, the officer's judgment must be employed to distribute it in such a manner over the vessel, that it may press upon the different parts of her, in proportion to their capacity to bear.

## **C H A P. XII.**

## MISCELLANEOUS ARTICLES.

## Upon the Polarity of a Sewing Needle.

THERE are few sewing needles but have a polarity, and when floated in water will tend to the magnetic meridian, the point of the needle going to the south. This is a necessary circumstance.

stance for seamen to be acquainted with, for should they be so unfortunate as to quit their vessels without a compass, by the aid of a common sewing needle, which seamen are seldom without, they are supplied with a tolerable substitute.

If a needle should be found without much polarity, hold the point towards the south, and rub it strongly from the middle towards the point with the back of a knife, and it will excite a very strong polarity.

A dry needle gently dropt into the water will swim of itself, but immediately on the upper part becoming wet it will sink.

If several rubbed needles be stuck together with their points one way through a very small piece of cork, they will move with a much quicker motion to the meridian than either of the needles singly.

*Upon Smoothing the Surface of the Sea, for the Purpose of Landing a Boat.*

A quantity of oil being distributed over the surface of the sea will prevent it from breaking, and greatly contribute to lower the swell. Was a boat before attempting to land upon a lee-shore, to bring up, and pour a quantity of oil upon

upon the water, till it spread itself, and smoothed the water between her and the shore, she might then venture to weigh, and have considerable chance of reaching the shore with safety.

*To preserve a Boat from Foundering in a Gale of Wind.*

To preserve a boat from foundering in blowing weather, it will be necessary to have with her a small spar, as a top-gallant-yard. Let this spar be equally spanned, and to the middle of it be made fast three or four fathoms of rope, with the boat's grapnel at the end. Now should it come on to blow hard, and the boat be in danger of shipping a sea, bend the boat's cable to the middle of the span, and let her ride by the spar, which will be prevented from heaving on board the boat by the grapnel. Thus, by the spar's extending across the bows of the boat, it will prevent the sea from breaking over her.

It will be necessary to ride the boat very close to the spar, and when the spar is not wanted, (should it be too large to take on board the boat), it may be towed end-on astern of her.

*On the Manner of acting upon Accidents happening  
to the Helm; and a Description of a temporary  
Rudder.*

Should a tiller break in a rudder-head, the rudder must immediately be chocked that the stump may be taken out and another tiller fitted, which should always be placed in readiness together with the chock, in case they should be wanted. While the rudder is useless, the ship must be hove-to till it is repaired; or some contrivance prepared to supply its place. The most ready application for supplying the place of a rudder is the following, till a better contrivance can be got ready. To a long stout boom, lash several pieces of junk and spars, about three fathom long, one beneath the other, and stiffen them across by several pieces of plank; to the bottom of this, fasten some pigs of lead to sink it, and let it be fixed to the stern, as represented by figure 18, plate 2, the end of the boom A being fastened to the stern-post, and the outer end supported by a strong topping-list from the taffarel. On each side of this temporary rudder are to be fixed guys from the span D, to haul it over to either side; the lower legs of the span must be shorter than the upper, that it may haul over with an obliquity which gives

it a tendency to dive, otherwise it might rise out of the water. The guys are to be led through stout blocks, lashed to booms rigged out upon each quarter, and to each is to be fixed a tackle, the falls of which are to be led under the barrel of the wheel, and several turns about it, and are then to be spliced taught together.

The leading of the falls under the wheel gives a great advantage; as the ship is steered by moving the wheel round the same way as if steering with a rudder. This contrivance will answer tolerably well, till the following rudder can be prepared, the invention of Captain Edward Packenham of the Royal Navy.

1, Fig. 15, plate 1, is a topmast inverted, which forms the main piece of the rudder, its heel becoming the head, which is so secured by the anchor hoops, 9, that the fid-hole may be increased to receive a tiller. This main piece is pointed through a topmastcap, which is enlarged, that the main piece may turn freely in it. Fig. 17, is a representation of the cap with its square part cut out to fit the stern-post, having fixed to it the top-chains. 2, Fig. 15, is the inner half of a jib-boom; 3, the outer half; 4, a fish, all of which are firmly bolted to the main piece, and planked over, as 6, 6, 6, &c. — 10, 10, 10, are pigs of ballast to sink the heel of the rudder;

rudder; 5, a rope to suspend the rudder. Fig. 16, anchor-stocks cut out to receive the round part of the main piece of the rudder.—The whole machine being prepared, let it be got under the stern, and its head be hove up through the counter to a necessary height. Then, to each of the top-chains, bend the end of a hawser from the hawse-holes;—bear the rudder amidships, and heave well taught the hawsers, which will firmly secure the cap to the stern-post. This done, let the anchor-stocks be secured round the rudder-head to the deck it comes through, that they may act as an upper gudgeon for the rudder to turn in;—the tiller, &c. being fixed, the vessel is now fitted with a rudder, nearly as perfect as her former.

*To Steer a Vessel which has lost her Rudder, by another Vessel.*

To steer a vessel which has lost her rudder, by another, let the *disabled vessel* take the other in tow, and make sail. To the tow-rope, at a few fathoms abaft the stern of the leading vessel, let steering-ropes be made fast, coming through blocks upon booms rigged out over each quarter and about the barrel of the wheel, as explained in the foregoing article. By turning the wheel round, the vessel astern is brought to tow a strain

upon either quarter of the leading vessel, forming a sort of temporary rudder by which she may be steered as required.

Let it be remembered that the vessel astern must steer the same course as the leading vessel; and when it is required to tack, the vessel astern should be sheered to leeward, and not put in stays till the leading vessel has come up three or four points in the wind.

*Upon recovering a Vessel upright, without cutting away her Masts.*

It often happens that by a sudden squall of wind a vessel is thrown over upon her beam ends, without a prospect of recovering her credit while she remains upon the same tack, therefore attempts are made to veer her; but as the rudder lies along the surface of the water it becomes useless, and as the sails are either blown from the yards, or become unmanageable, recourse is had to cutting away the main-mast and mizen-mast, that the ship may veer under the fore-mast:—a most desperate expedient, particularly if the ship is far distant from port! Upon this occasion, that the ship may be recovered upright without cutting away her masts, let the following method be practised. If she is in a situation where she can be brought to an anchor,

Let go her lee-anchor, which will swing her wind-  
rode, and relieve her from the strength of the  
wind; but should she, in this dreadful situation,  
be at sea, let the end of a hawser be handed over  
the lee-quarter and round to windward, and to  
it be bent any of the small anchors,—half-butts,  
—spanned gratings,—or any thing at hand that  
will act as stopwaters; then throw the whole  
overboard, and veer away upon the hawser to a  
necessary quantity, when make it fast. Now by  
the ship's drifting from this tow, it will pull with  
such power upon her stern as to veer her, and  
bring the wind upon the opposite side.

*To clear Vessels that have run aboard each other.*

It frequently happens that two vessels which  
have run aboard each other are so completely  
bound together, either by the tide, or the wind  
and sea, that it is out of the power of the helm  
and sails to force them asunder. On this occa-  
sion, if the vessels are in a situation where they  
can come to an anchor, let one of them bring  
up and the other will drift clear of her: but  
should they be at sea, let the weathermost vessel  
be brought up by the floating anchor, page 44,  
or by a tow from her bow, as mentioned in the  
foregoing article.

*Upon Steering a Ship which has lost her Fore-mast.*

A ship that has lost her fore-mast can only be steered with the wind aft, and that not without being subject to broach-to. Directly a ship in this situation receives the wind sideways, all the lateral pressure of her sails will be abaft the centre of gravity, which her rudder not being able to counteract, must oblige her to approach the wind; but could the power of the rudder be increased to any required degree, a ship could be steered with the wind beaming, notwithstanding the loss of her fore-mast. To do which, let the following method be practised:—veer astern 20 or 30 fathom of cable, which, if the ship is in shoal water, should be buoyed up. Then rig out a boom with a stout guy upon each quarter, and let the guys be bent to the cable a few fathoms abaft the stern. While the ship is sailing before the wind, let the cable be guyed to tow amidships of the stern, and it will prevent her from broaching-to; but while the wind blows sideways upon the ship let it be guyed out to the lee-boom, which will greatly assist the weather-helm.

Upon

*Upon hauling a Vessel off a steep Shore in a Calm.*

It has often happened that vessels have been driven, in calm weather, upon a steep and dangerous shore which has denied anchorage, but might have been saved by exertion and judgment. Cases of this kind require great animation on the part of the officers. All boats must be immediately hoisted out to tow the ship, if possible, from her perilous situation. In the mean time let stop-waters be got ready to run out from the vessel, and haul her off, should towing prove ineffectual. Large butts cut in halves and flung, serve excellently for this purpose, and are used with advantage in the following manner. Let each boat take several of these half butts, and row away from the vessel with a coil or two of small rope: when the rope is out, span the boat from head to stern, and tow the half butts from the opposite gunwale of the boat, at several fathoms distance; thus, when the rope is hauled in on board the vessel, the boat will hang athwart, and, together with the half butts, must oppose considerable resistance. To draw the vessel ahead, let the boats employed row out alternately, that one line may be in readiness to haul upon, when the other is all on board. Should it remain calm, or should

there be a light air of wind oppoſed to the vessel's course, the ſails muſt be furled.

*To prevent rolling away the Masts upon coming out  
of Port, with new Rigging, immediately into a  
bigg Sea.*

Vessels have frequently rolled away their masts from coming ſuddenly out of port into a high ſea with new rigging. On an occaſion of this kind, if one of the bower anchors be let go; and a neceſſary quantity of cable wore away, it will bring the ſhip's bow to the ſea, when ſhe will roll leſs, and afford an opportunity for ſecuring the masts. Lieutenant Thomas Owen, of the Royal Navy, informed me that he ſaved the masts of a vessel, thus circumſtanced, by the aboye means.

*A Mode of fitting Top-gallant-fids, that they may be  
swung about, taken out with Ease.*

It frequently happens in gales of wind, from the inclination of the ſhip, and the strength of the wind, that a top-gallant-mast is ſo completely bound, between the cap and the trefleſtrees, as to render it imposſible to ſway it up to take out the fid; to remove this inconveniēnce is the intention of the following contrivance. Let B,

plate 9, figure 19, be a stout brass sheave, or roller, at the upper part of a top-gallant-fid hole for the mast to rest upon; CD a fid of iron, circular at the upper side, and going off to a point at C; A, A the trestletrees; 2, 2, plates of iron for the fid to rest upon; D, a hole to lash the fid to the heel of the mast to prevent its working out. Upon considering this plan of fidding a mast, it must appear clear, that by a slight blow of a maul at the end of C, the fid will be forced out, though the mast should not be lifted.

*Upon diminishing the Steeving of Bow-sprits.*

As every position of the rudder, except a middle one, takes from the speed of the vessel, it should be preserved as much amidships as possible. Almost every ship under full sail, with a side-wind, carries a weather-helm; to counteract which, it is recommended to lower the steeving of the bowsprit to an angle of 5, or 10 degrees with the keel, and to increase the jib-boom in stoutness, that a large jib of strong canvas may be carried, in most weathers. With the bowsprit lowered, it will be better without a spritsail-yard; and let the jib-boom be secured from the cat-heads and stem, by a standing and travel-

travelling guy on each side, and a standing and travelling martingal.

To rig a ship so as to have all her yards  
of equal size, will be a great convenience.

*Upon equalizing the Sails, Yards, and Masts, of the  
Fore and Main-masts.*

A considerable convenience would arise from having the fore and main-top-sails of the same size, also the fore and main-top-gallant-sails, and the masts and yards appertaining to them, as it frequently happens that accidents fall more to the lot of one mast than the other. The main-mast I would still continue taller than the fore-mast, that the spaces beneath the top-sails and top-gallant-sails of the main-mast may be above the same spaces upon the fore-mast, to prevent the losing any wind, and that the lower yards may not lock together in going about.

*Upon Compasses, and Binnacles.*

When a compass is not in use its card should be taken off the point. All compass-cards that are unhung should be placed together in pairs, the North point of one to the South point of the other, wrapped up in dry brown paper, and separated a small distance from any other pair:

if they be thus packed, their needles will increase in magnetical virtue.

Great care should be taken that the sides of all the binacles are placed in a line parallel to the longitudinal axis of the vessel, thus all the binacles will be parallel to each other; and as the lines within a compass bowl are parallel to the sides of its box, by placing either side of the compass box to either side of the binacle, the line in the compass bowl must stand parallel to the longitudinal axis of the vessel. For want of paying proper attention to setting the compasses parallel to each other, they are frequently said to differ, when upon a nicer examination out of the binacle they are found to agree.

Again, all binacles should be either pegged together, or nailed with brass nails.

in case of time before this meeting will be  
called in executive notice.

First case should be taken into the order of  
the passage in place of the battle or

**C H A P. XIII.**

He who has to make his division shall

divide it into two parts, one to be

left and the other to be

right, and each part to be

commanded by a captain of equal rank.

**Of the Command and Division of Fleets.**

THE whole fleet is under the general direction of one commanding officer; but for the sake of discipline it is divided into three grand divisions of equal force, denominated the centre, van, and rear divisions. The centre is more particularly commanded by the superior officer of the fleet, the van by the second officer in command, and the rear by the third officer.

Besides these division, for particular services it is found necessary to have squadrons, composed of ships having particular qualities.

The ships of the centre divisions are known by carrying their distinguishing-vanes at the main, the van division by carrying their vane at the fore, and the rear division by carrying their vane at the mizen; each commanding officer being distinguished by his flag at the

main,

*main; fore, or mizen, according to the rank  
he bears; and so on. The more easily suscep-  
tible it is to confusion, the less it is to be expected  
from it. The order of sailing will be given  
in due time.*

## *Of the Order of Sailing.*

The order of sailing is, that particular order which a fleet preserves for the sake of regularity when pursuing its proper course. The disposition of this order rests with the commander of the fleet. It should be so contrived that the ships may not molest each other, and yet be capable of assuming the order of battle and retreat with facility. We shall consider the order of sailing throughout this chapter as composed of three lines, the ships sailing abreast of each other, because lines can more readily assume the order either of battle or retreat.

## Of the Order of Battle.

A fleet is in the order of battle when the ships are one ahead of the other, in a line six points from the wind, either upon the starboard or larboard tack.

### *Of the Order of Retreat.*

We shall here consider the order of retreat only in a line at right-angles with the direction of

of the wind, because hence the order of battle is more easily attained. The intention of this order is to conduct a fleet of merchantmen from the enemy with safety. The merchantmen are to situate themselves before the order of retreat, and not to extend without the line on either side.

#### *Of the Lines of Bearing.*

The line of direction which a fleet preserves in either of the orders, is termed the line of bearing of the order. Thus the line of bearing of the order of battle is fix points from the wind on either tack; the line of bearing of the order of retreat is across the wind; and the line of bearing of the order of sailing is the course steered.

#### *Of Manoeuvring in Succession.*

When a fleet of ships tack or perform any manœuvre, one after the other, in the wake of the next ahead, it is termed tacking or manœuvring in succession.

P R O

as mentioned in a former chapt. to star sides  
and a windward, followed by windward or starboard

**P R O B L E M I.** It has often been  
said that small ships should follow a windward

To form the Order of Sailing in Three Lines, the  
Fleet being irregular.

To form this order with the least confusion,  
the ships leading the starboard and larboard  
lines are to take their stations abreast of the van  
ship of the centre line, leading on under easy  
sail; and the rest of the ships are to search out  
and follow their next ahead.

**P R O B. II.**

From the Order of Sailing, with the Wind ast, to form  
the Order of Battle.

Let the small circles in the three lines FG,  
HI, KL, plate 3, figure 1, represent a fleet in  
the order of sailing, with the wind in the direc-  
tion of the arrow; then D. B. is the starboard  
line of bearing from the van ship of the star-  
board line; and AC is the larboard line of bear-  
ing from the van ship of the larboard line.

If it be required to form the order of battle  
on the starboard tack, the van ship of the star-  
board line is to haul her wind on the starboard  
tack, and sail along the line of bearing D B,

the

the rest of her line following in succession as they arrive in her wake, at the point K; and the centre and larboard lines are to haul in succession a point to starboard, and steer along the dotted lines H A F D, which will bring their vans at the points A and D in the line of bearing, at the same distance they held from each other in the order of sailing. When the vans are arrived at the points A and D, their lines are to heave-to; the centre making sail again when its van can join at a proper distance from the rear of the starboard line, and the larboard line making sail when its van can join at a proper distance from the rear of the centre line: thus when the rear ship of the larboard line has arrived at D, the whole fleet will be in the order of battle, as represented by the large dots in the line of bearing DB.

To form the order of battle on the larboard tack, the van ship of the larboard line is to haul her wind along the larboard line of bearing A.C. the rest of the fleet following as before related.

## P R O B. III.

*From the order of Sailing with a Side Wind, to form  
the Order of Battle on the same Tack.*

Let the small circles, plate 3, fig. 2, represent a fleet in the order of sailing with the wind on the larboard side, in the direction of the arrow: then AC is the larboard line of bearing from the van ship of the lee-line.

The van ship of the lee-line being in the line of bearing, this line is to heave-to; the centre and weather-lines bearing up in succession to a course as much off from the former course as half the angle ACD, formed by the line of the ships abreast, and the line of bearing; thus their vans will arrive at the points B and A in the line of bearing, at the same distance they held in the order of sailing.

The centre-line is to heave-to when its van arrives at the point B, and the weather-line is to haul the wind in succession along the line of bearing, as the ships arrive at the point A. The other lines are to make sail again and follow, as mentioned in the foregoing problem.

The van of the centre-line is in the line of bearing, when the van of the lee-line bears six points from the opposite point to the wind; and

the van of the weather-line, when the van ships of the lee-line are in the same direction.

To form the order upon the other tack, first form the order upon the same tack, then tack in succession.

NOTE.—If the right-angle EDC be so divided by the line DA, that the angle EDA be equal to half ACD, the triangle ACD is isosceles, having the leg AC equal to DC.

#### P R O B. IV.

*From the Order of Sailing with the Wind aft, to form the Order of Retreat.*

Let the small circles in the three lines of plate 3, fig. 3, represent a fleet in the order of sailing, the wind being aft, in the direction of the arrow. Then AC is the line of bearing of the order of retreat.

If it be required to form the order of retreat to starboard, let the van ship of the starboard-line haul along the line of bearing, on the starboard tack, keeping the wind abeam; the remainder of the lines following as related in problem 2. When all the fleet are in the line of bearing, they are to bear away together, and steer the intended course, as represented by

the

the dotted parallel lines, regulating their sails so as to continue in a line across the wind.

### P R O B . V.

*From the Order of Sailing with a Side Wind, to form the Order of Retreat.*

Let the small circles, plate 3, fig. 4, represent a fleet in the order of sailing with a side wind, in the direction of the arrow. Then CA is the line of bearing of the order of retreat, from the van ship of the lee-line.

The van ship of the lee-line being in the line of bearing, this line is to heave-to, the centre and weather-lines bearing up in succession to a course as much off from the former course as half the angle BCD, for the reason given in prob. 3. The centre line is to heave-to when its van arrives at the point B, the weather-line hauling its wind abeam at the point A, along the line of bearing CA, the lee-lines following in succession, as related at the conclusion of problem 2. When all the ships are in the line of bearing, they are to bear away altogether to the intended course, as shewn by the parallel lines.

## P R O B. VI.

*From the Order of Battle to form the Order of Sailing, on the same Tack, upon particular Bearings.*

Let AC, plate 3, fig. 5, represent the order of battle upon the larboard tack; A<sub>1</sub>, B<sub>2</sub>, C<sub>3</sub>, the intended lines of the order of sailing from the ships A.B.C. which are to become the van ships of the three lines.

Now, to form the order of sailing, let the van ships A.B.C. bear away, and steer along their respective lines of bearing, the rest of the ships following in succession. When the weather-line has formed, it is to heave-to; when the centre is abreast of the weather, it also is to heave-to; and when the lee-line is abreast of both, they are to make sail.

If the lines are now at an improper distance, let them regulate accordingly.

## P R O B. VII.

*From the Order of Battle, to form the Order of Retreat.*

Let AB, plate 3, fig. 6, be the order of battle on the larboard tack, and BC the line of bearing of the order of retreat.

Now, to form the order of retreat, the rear ship B of the line of battle is to heave-to, and the rest of the ships are to bear away, and steer with the wind one point upon the larboard quarter, till they successively bring the ship B at right angles with the wind, when they are to heave-to. The ships being arrived in the order of retreat, they are to proceed upon the proper course, being careful to regulate their sailing so as to preserve themselves in a line across the wind.

Was the fleet in a line upon the starboard tack, the rear ship is to heave-to, and the rest are to steer with the wind a point upon the starboard quarter, till they bring the rear ship at right angles with the wind. By steering along with the wind a point quartering, the fleet sails along the dotted parallels, and arrives in the order of retreat at the same distance each ship held from the other in the order of battle, for ABC is an isosceles triangle.

P R O B .

## P R O B . VIII.

*From the Order of Retreat to form the Order of Sailing, with the Wind on the starboard Side.*

Let A.B.C. plate 3, fig. 7, represent the order of retreat, A<sub>1</sub>, B<sub>2</sub>, C<sub>3</sub>, the three lines of the

L 3

order

order of sailing from the ships ABC, which are to become the vans.

Now, to form the order of sailing, let the van ships A.B.C. steer along their respective lines of bearings, the rest of the fleet hauling the wind abeam, and following their van, as they successively arrive in their wakes at the points A.B.C. When the weather-line C<sub>3</sub> has formed, it is to heave-to, the centre doing the same when abreast of the weather-line; and when the lee-line is abreast of both, they are to make sail. If the lines be now at an improper distance, they are to regulate accordingly.

To form the order with the wind on the larboard side, D is to become the van of the weather-line, and the ships are to haul the wind upon the larboard tack, following their respective vans.

#### P R O B . IX.

*From the Order of Retreat, to form the Order of Battle.*

Let AD, plate 3, fig. 6, represent the ships in the order of retreat, and AB the larboard line of bearing of the order of battle.

Now, to form the order of battle on the larboard tack, the larboard ship A, which is to be-

come the van of the order of battle, is to heave-to on the larboard tack, and the remainder of the ships are to steer with the wind a point upon the larboard quarter, till they bring the van to bear six points from the wind, when they are to heave-to on the larboard tack. Thus they will proceed along the dotted parallels, and arrive in the order of battle at the same distance from each other they held in the order of retreat, BAD being an isosceles triangle.

If it be required to form upon the starboard tack, the ship D is to heave-to upon the starboard tack, and the rest are to steer with the wind a point upon the starboard quarter, till D bears six points from the wind, when they are to heave-to on the starboard tack.

### P R O B. X. 8

#### *To work to Windward in the Order of Sailing.*

Let the three lines, A<sub>1</sub>, B<sub>5</sub>, C<sub>9</sub>, plate 3, fig. 8, represent the lines of bearings of the order of sailing when close hauled upon the larboard tack, and the three lines 1C, 5D, 9E, the three lines of bearings, when close hauled upon the starboard tack, and the small circles numbered 1, 4, 7, the van ships in the order of

sailing upon the larboard tack abreast of each other.

To explain the manner of performing this problem, for the sake of simplicity, we shall consider the manœuvres of the three van ships only, which is sufficient, as the remainder of the ships are to tack in succession after their respective van.

Now, to form the order of sailing on the other tack, let the van ship 1 of the lee-line tack and stand on; and when the van ship 4 of the centre line brings the van of the lee-line four points abreast her lee-beam, viz. in the direction 5.2. she is to tack; the van of the weather line tacking when the van of the centre is four points abreast her lee-beam, viz. in the direction 9.6. at which time the ships will be abreast of each other upon the starboard tack, as represented by the large dots 3. 6. 9. □ O R T.

#### P R O B. XI.

*To work to Windward in the Order of Battle.*

To work to windward in the order of battle, the van ship is to tack first, and the rest are to tack in succession in the wake of the next a-head.

P R O B.

Imperial Navy, All orders of battle are made  
in ships of the line, and so it is in  
PROB. XII.

*To rebrace the Order of Battle, should the Wind  
come forward less than six Points.*

Let AB, plate 3, fig. 9, be the order of battle before the wind shifts, BC the line of bearing of the order of battle from the rear ship after the wind has shifted.

Now, that the ships may form in the line of bearing BC, let the rear ship B heave-to, and the rest bear off, and bear up as many points from the line AB as half the difference between 16 and the number of points the wind has altered, added to what it has altered, till each ship, from rear to van, shall successively bring the rear ship to bear six points from the point opposite to the wind, when they are to heave-to, till the line be formed as they are in the line of bearing.

*Demonstration of the foregoing Rule for bearing  
and bearing up.*

That the ships in the line of battle AB may form, at their respective distances, in the line of bearing BC, it is necessary that the course of each ship shall be parallel to the base of the isosceles triangle ABC. Therefore, each must bear

bear up equal to the angle DAC, which is equal to CAB plus CBA. Now, ABC is equal to what the wind has shifted; and as all the angles together of the isosceles triangle ABC are 16 points, the angles at the base must each be half the difference between the angle B and 16.

## P R O B. XIII.

*To restore the Order of Battle, should the Wind draw aft less than six Points.*

Let AB, plate 3, fig 10, be the order of battle before the wind changes; AC the line of bearing of the order of battle after the wind has changed. Now, that the ships may form in the line of bearing AC, the van ship is to heave-to, and the rest are to bear up equal to angle ABC, which is half the difference between 16 points and what the wind has changed: thus they will proceed along the dotted parallel lines; and as each ship, successively from van to rear, shall bring the van ships to bear six points from the wind, she is to heave to, as then she is in the line of bearing.

*To regulate the Distances of the Ships.*

As it is impossible to regulate the distances of ships from each other by guess, would it not be better

better, as the masts of ships of the line are not very dissimilar in height, to regulate it by keeping the main-top-gallant truck of the ship next ahead, at a particular altitude above her water-line, which may be readily done by a quadrant, and would substitute somewhat of truth in the lieu of guess. For the sake of example, let it be presumed, that from the truck to the water-line is 168 feet, then for the ship ahead to be half a cable off, her truck and water-line must subtend an angle of about 25 degrees, at a cable off about 13 degrees, and at two cables off about 6 degrees.

The distance of the lines from each other should be half their length, which will give sufficient room for manœuvring. They will be at this distance from each other, if the rear of the centre be in station, when the rear of the centre-line, observed from the van ships of the starboard and larboard lines, subtends an angle of 26 degrees with their wakes.

you are anxious to wish to have such a signal composed, it will consist of a single flag hoisted in the middle of your ship's mast, or of a small square flag hoisted in the foremast, and suspended by a yard arm, which may be either a top-gallant yard or a top-mast yard, and so far above the deck as to be visible from a distance.

### C H A P. XIV.

#### ON SIGNALS.

All signals, to be effectual, must be simple, and composed in such a manner as to express the same signification at whatever mast-head, or yard-arm, they may be displayed from. The following day signals will be found to have these advantages.

The plan is, to express numbers by distinctly coloured flags, each number referring to a certain signification, to be agreed on before-hand.

*Mode of expressing 999 Numbers, by Eleven Flags and One Pennant.*

In the table of flags, plate 3, there are ten flags, each flag representing the *number* placed against it, and a substitute flag representing the *same number* with any flag which may have been hoisted next above it. To express from 9 to 99, hoist the flag standing for the first figure of the given number, above the flag standing for the second; that is, to express 45, hoist flag 4, above flag 5, as shewn plate 3, figure 11;—but should

the

the given number be two similar figures, for instance 55; it is to be expressed by hoisting flag 5, above the substitute, as shewn, plate 8, figure 12. To express from 99 to 999, hoist the flags one above the other in the order of the figures of the given number;—thus, 245 is expressed by hoisting flag 2, above 4, above 5; and 225 by flag 2, above the substitute, above 5; and 522, by flag 5, above 2, above the substitute. But as there are some instances in which the eleven flags are insufficient to express numbers above 99, a short thick pennant, denoting that the last figure of the given number is the same as the first, is proposed to remedy the defect; therefore, to express 545, which is a number that could not be expressed by the eleven flags, hoist flag 5, above 4, above the pennant; also to express 444, hoist flag 4, above the substitute, above the pennant.

Should it not be required to express more than 199 signals, it will be found more simple to let the pennant express 100.

Each flag is to be marked on the tabling with the number it represents, (which will identify the flag) and is to be fitted with a tack about a fathom long, so that when one flag is bent to the tack of another, they may appear *distinct*, at a distance, when they are displayed.

As

As flag signals are frequently rendered indistinct, either from position, want of wind, or a dull light, the author presumes that day signals composed of cones and cylinders would be the most perfect kind hitherto invented, since they neither require wind, nor a very distinct light, and have *the same appearance from every horizontal position.* By means of the eleven shapes contained in the table of shapes, plate 3, —— 999 numbers may be expressed. These shapes represent the same signification with their corresponding flags, and the one, figure 14, performs the office of the pennant; therefore the numbers are expressed by them in the same manner as by the flags.

These shapes may be made of light wicker, and painted black; and if about three feet diameter, they will appear distinct to a considerable distance. I have often observed a top-gallant-truck, an object not more than a foot over, when the colour of the flag hoisted to it was perfectly indistinct.

Should the room these shapes occupy, when made of wicker, render them objectionable, they may be formed of canvas, set out with hoops; thus made, they will collapse into a small compass when they are out of use.

The shapes will shew to greater advantage if they be hoisted to the yard-arms, or stays, as re-  
pre-

presented by figure 13, plate 3, instead of the mast-heads.

In blowing weather, or when, from circumstances, ships cannot approach near enough to each other to hail, it will be found convenient to have a light board, about eight feet by three, painted black, that the latitude, longitude, and any short sentences may be communicated by writing upon the board with chalk. Upon shewing the board, wave a small white flag to the ship you wish to communicate with, which is to be repeated by her when the writing is understood.

A telegraph will also be found extremely convenient to express the numerical signals, and may be formed in the following manner. Fig. 15, plate 3, represents a large board, contrived to turn round upon the pole AC:—BD, BD are grooves to receive the figures of the number to be shewn, as represented by 453, each figure being painted black upon a thin white board or sheet of tin. Let the other side of the board be prepared with grooves in the same manner, for the convenience of fixing another number while the first is exhibiting. Between each exhibition, wave a white flag, to denote that the number is understood.

By the addition of an alphabet to this telegraph, words may be expressed to distant parties:

for

for instance, let each party have a *dictionary* with the words numbered, under each letter of the alphabet, from one throughout; then to express any word, shew its number and the letter it begins with, as represented in the figure by A 453.

To communicate a sentence expeditiously, let it be written as short as possible, leaving out such words as can be omitted without destroying the idea; and above each word write the number placed against it in the dictionary: a sentence thus prepared, and placed before the person who attends the telegraph, will very much facilitate the communication.

*Significations.*

The ships of the fleet are to be denoted by particular vanes, fixed at either of the mast-heads. Each ship is also to have assigned to her a particular pennant, which, being hoisted alone, expresses a wish to communicate with that ship; but when hoisted with a signal, expresses that the signal particularly applies to her.

*General*

*General Significations.*

- 0 An acknowledgment that the signal is understood by the fleet.
- 1 Annulling.
- 2 Tack, headmost and weathermost first.
- 3 Veer, sternmost and leewardmost first.
- 4 Make sail.
- 5 Shorten sail.
- 6 Ships ahead, shorten sail.
- 7 Ships astern, make more sail.
- 8 Gather together.
- 9 Open to a greater distance.
- 10 Heave-to on the starboard tack.
- 11 Heave-to on the larboard tack.
- 12 Take in your studding-sails, and prepare to haul the wind.
- 13 Haul the wind to starboard.
- 14 Haul the wind to port.
- 15 Ships to starboard, join the fleet.
- 16 Ships to port, join the fleet.
- 17 Continue as before, though the commodore does otherwise.
- 18 Prepare to hoist foreign colours, (I will shew the nation's jack I mean.)
- 19 Shew no lights during the night, and keep in close order, as I shall carry no top-light.

- 20 A strange sail is suspected to be in the fleet, any ship discovering her, is to hoist her ensign and run towards her.
- 21 Disperse, and each ship do the best for herself.
- 22 Be particularly attentive, as I am going to make several signals which I intend to have executed in the night.
- 23 Observe my telegraph.
- 24 For all commanders, or a particular commander.
- 25 For an officer from every ship, or a particular ship.
- 26 Open your signal letter.

To prevent these signals being of service to the enemy, let each ship be furnished with a signal letter, expressing, that "hereafter the numbers annexed to the significations will be shifted." For instance, let the significations in future be numbered 1, 2, 3, &c. instead of 0, 1, 2, &c. &c. &c.

Hours	Hours
A. M.	P. M.

*Hours after Dark.*

27	At the hour of	6	
28	Ditto	-	7
29	Ditto	-	8
30	Ditto	-	9
31	Ditto	-	10
32	Ditto	-	11
33	Ditto	-	12
84	Ditto	-	1
35	Ditto	-	2
36	Ditto	-	3
37	Ditto	-	4
38	Ditto	-	5
39	Ditto	-	6

before midnight.

midnight.

after midnight.

The purpose of these signals will be seen by the two following examples. Let it be presumed that the fleet should be chased during the day, and that it is the intention of the commodore to avoid the enemy by altering the course after dark. To make a signal during the night for this purpose would shew his situation; therefore, before dark, let the commodore shew the hour he intends to alter his course, and the course he means to steer. Or should the commodore imagine he has not sufficient run for the night, let him shew the hour he intends to heave-to, which will prevent considerable confusion, as

each ship will be prepared for the circumstance, and upon the look-out to avoid those which have already hove-to.

*Points of the Compass.*

40	North	48	East	56	South	64	West
41	N b E	49	E b S	57	S b W	65	W b N
42	NNE	50	ESE	58	SSW	66	WNW
43	NE b N	51	SE b E	59	SW b S	67	NW b W
44	NE	52	SE	60	SW	68	NW
45	NE b E	53	SE b S	61	SW b W	69	NW b N
46	ENE	54	SSE	62	WSW	70	NNW
47	E b N	55	S b E	63	W b S	71	N b W

These signals are to shew the course to be steered; or the bearings of an object pointed out by signal.

*Significations which may be expressed by Ships of the Fleet.*

- 72 A strange sail.
- 73 Two strange sail.
- 74 Three strange sail.
- 75 A fleet.
- 76 Request the assistance of a surgeon; ship nearest, to send her surgeon.
- 77 Request the commodore to go ahead, to set up my rigging.
- 78 Request to speak the commodore.
- 79 We are over-pressed with sail.
- 80 We have sprung a leak.

- 81 A mutiny is on board us.  
 82 We see the land.  
 83 We have got soundings.  
 84 We require immediate assistance.  
 &c. &c.

*Significations addressed to particular Ships.*

- 85 Come within hail.  
 86 I intend to send a boat on board you.  
 87 Send a boat.  
 88 Lead the fleet.  
 89 Take a particular ship in tow. (The tower  
     and tow's pennants will be shewn.)  
 90 Cast off the ship in tow.  
 91 Make sail upon particular bearings, (as will  
     be shewn by the bearings expressed) and  
     look out for the land.  
 92 Make sail upon particular bearings, and  
     sound.  
 93 Chase upon particular bearings.  
 94 Bring the stranger to the commodore.  
 95 Examine the stranger. If neutral, pass her.  
 96 Hoist the admiralty signal.  
 97 Return to the fleet.  
 98 Situate yourself between the distant ships  
     and the fleet, to repeat signals.  
 99 Keep your station.  
 &c. &c.

*Question-Significations.*

- 100 Do you see the land ?  
 101 Have you got soundings ?  
 102 Do you gain upon the chase ?  
 103 Is the chase a friend, enemy, or neutral ?  
 104 Is she of force ?  
 105 What was your longitude by the mean of  
 your late observations, continued on, by  
 the chronometer, to the preceding noon ?  
 106 What was your longitude by the chrono-  
 meter, at the preceding noon ?  
 107 What was your latitude by meridian, or  
 double altitude, at the preceding noon ?  
 108 What is your variation ?  
 109 What are your soundings ?  
 110 How many strange sail do you count ?  
 &c. &c.

All these questions are to be answered as ex-  
 plained under the head, " *Answering-Signifi-  
 cations.*"

*Answering-Significations.*

- 111 No.  
 112 Yes.  
 113 Friend.  
 114 Neutral.  
 115 Enemy.  
 116 Suspicious.

117 I cannot say.

118 Inability.

119 Your signal is not distinct.

&amp;c. &amp;c.

N. B. Longitude, latitude, and variation, are to be answered by first hoisting the flags expressing the number of the degrees, which being understood, then hoist the flags expressing the number of minutes; and if the number of sail you count, or your soundings be required, answer by hoisting the flags expressing the number of sail, or the number of fathoms. Whenever the flags are intended to express a number, hoist a short white pennant with them to prevent their being taken for a signification.

*Significations respecting Anchoring, and such as will apply only when at Anchor.*

120 Repair on board, every person belonging to the fleet.

121 Prepare to sail.

122 Unmoor.

123 Moor.

124 Lie at single anchor.

125 I shall get under way in the night. (The hour will be shewn.)

126 Weigh, outermost and leewardmost ships first.

- 127 Prepare to anchor.  
 128 Anchor.  
 129 Cut, or slip, outermost and leewardmost first.  
 &c. &c.

*Regular Manoeuvring-Significations.*

- 130 Form the order of sailing.  
 131 Form the order of battle upon the starboard-tack.  
 132 Form the order of battle upon the larboard-tack.  
 133 Form the order of retreat.  
 134 Starboard-line, heave-to.  
 135 Centre-line, heave-to.  
 136 Larboard-line, heave-to.  
 137 Starboard-line, make sail, and follow in succession.  
 138 Centre-line, make sail, and follow in succession.  
 139 Larboard-line, make sail, and follow in succession.  
 140 Tack altogether.  
 141 Tack in succession.  
 142 Tack, and continue in the order of sailing.  
 143 Rear ship, heave-to; the rest form in the order of retreat.  
 144 Starboard ship, heave-to; the rest form the order of battle, on the starboard-tack.  
 145 Lar-

- 145 Larboard ship, heave-to; the rest form the order of battle, on the larboard tack.  
 146 Rear ship, heave-to; the rest form again in the order of battle, upon the same tack.  
 147 Van ship, heave-to; the rest form again in the order of battle, upon the same tack.  
 &c. &c.

N. B. These significations are adapted to the manœuvres explained in the Chapter "On manoeuvring a Fleet." The commander of the fleet will fire a gun at the instant any of these manœuvres are to be executed.

*Significations appertaining to Battle.*

- 148 Keep the people to their quarters.  
 149 Exercise the great guns, and small arms.  
 150 Van division, engage.  
 151 Centre division, engage.  
 152 Rear division, engage.  
 153 Engage generally.  
 154 Leave off engaging.  
 155 Assist a disabled ship.  
 &c. &c.

*Night-Signals.*

Night-signals should be used as little as possible, since they are frequently misunderstood. Of necessity, they must be composed either of sound or lights, or the two blended together. If several lights are shewn together, that they may have the same appearance from every horizontal situation, it will be necessary to hoist them in a vertical position. In the following signals, this circumstance is attended to: the plan is, to express numbers by different kinds of lights; guns being fired merely to call the attention of the fleet, prior to making any signal.

To express numbers, let each light represent one, each rocket five, and each blue-light ten, as shewn in the following table.

*Significations.*

Numbers.	Lights.	Rockets.	Blue-lights.	
1 1				A general acknowledgment that the signal made is understood.
2 2				Tack, headmost and weathermost first.
3 3				Veer, sternmost and leewardmost first.
4 4				Heave-to upon the starboard tack.
5	1			Heave-to upon the larboard tack.
6 1	1			Annul the preceding signal.
7 2	1			Make sail.
8 3	1			I am overpressed with sail.
9 4	1			Shorten sail.
10	1			To shew my situation.
11 1	1			Headmost ships shorten sail.
12 2	1			Request to speak the commodore.
13 3	1			The fleet continue their course, though the commodore does otherwise.
14 4	1			I am in distress.
15	1	1		On discovering danger.
16 1	1	1		A stranger is suspected to be in the fleet.
17 2	1	1		Haul two points to starboard.
18 3	1	1		Haul two points to port.
19 4	1	1		North.
20		2		N. E.
21 1		2		East.
22 2		2		S. E.
23 3		2		South.
24 4		2		S. W.
25	1	2		West.
26 1	1	2		N.W. &c. &c.

*Instructions and Remarks.*

While the commodore is laying-to, it will be proper for him to carry a light at the bow-sprit end; also, upon any ship's thwarting, to save a man, or other circumstance, let her shew one light forward and two aft, that other ships may see her situation, and know the position of her head.

Upon the signal being made to tack or veer, let every ship, as she gets upon the other tack, carry a light for a short time at each cat-head, to shew that she is about.

In dark, disagreeable weather, the commodore should frequently make the signal "To shew his situation," and should avoid manœuvring during the night as much as possible.

Whenever a signal is made by the commodore, the top light should be covered, to prevent a confusion of lights.

All signal-lanthorns should be made of glass, and be big enough to hold several candles, for the sake of a brilliant light.

To discover whether a ship is of the fleet or not, shew *three* horizontal lights to her, and let the answer be *two* horizontal lights; or, let a *sign* and *counter-sign* be agreed upon—as, hail the suspected

suspected vessel with the words, *Lord Howe*, and let the answer be, *The first of June*.

### *Fog-Signals.*

Fog-signals can only be composed of sound, at different intervals, as shewn in the following table of significations.

### *Significations.*

- 1 gun, at intervals—To shew my situation.
- 2 guns, quick—Stand upon the starboard tack.
- 3 guns, quick—Stand upon the larboard tack.
- 2 guns, a minute separate—Lay-to on the starboard tack.
- 3 guns, a minute separate—Lay-to on the larboard tack.
- 2 guns, 2 minutes separate—Make sail.
- 3 guns, 2 minutes separate—Shorten sail.
- 4 guns, quick—Require assistance.
- 5 guns, quick—Discovering danger.

*Instructions.*

All ships upon their proper tack and course are to beat drums and ring bells at intervals.

All ships, either upon the wrong tack, or off their course, or laying-to, are to fire muskets continually till they renew their course.

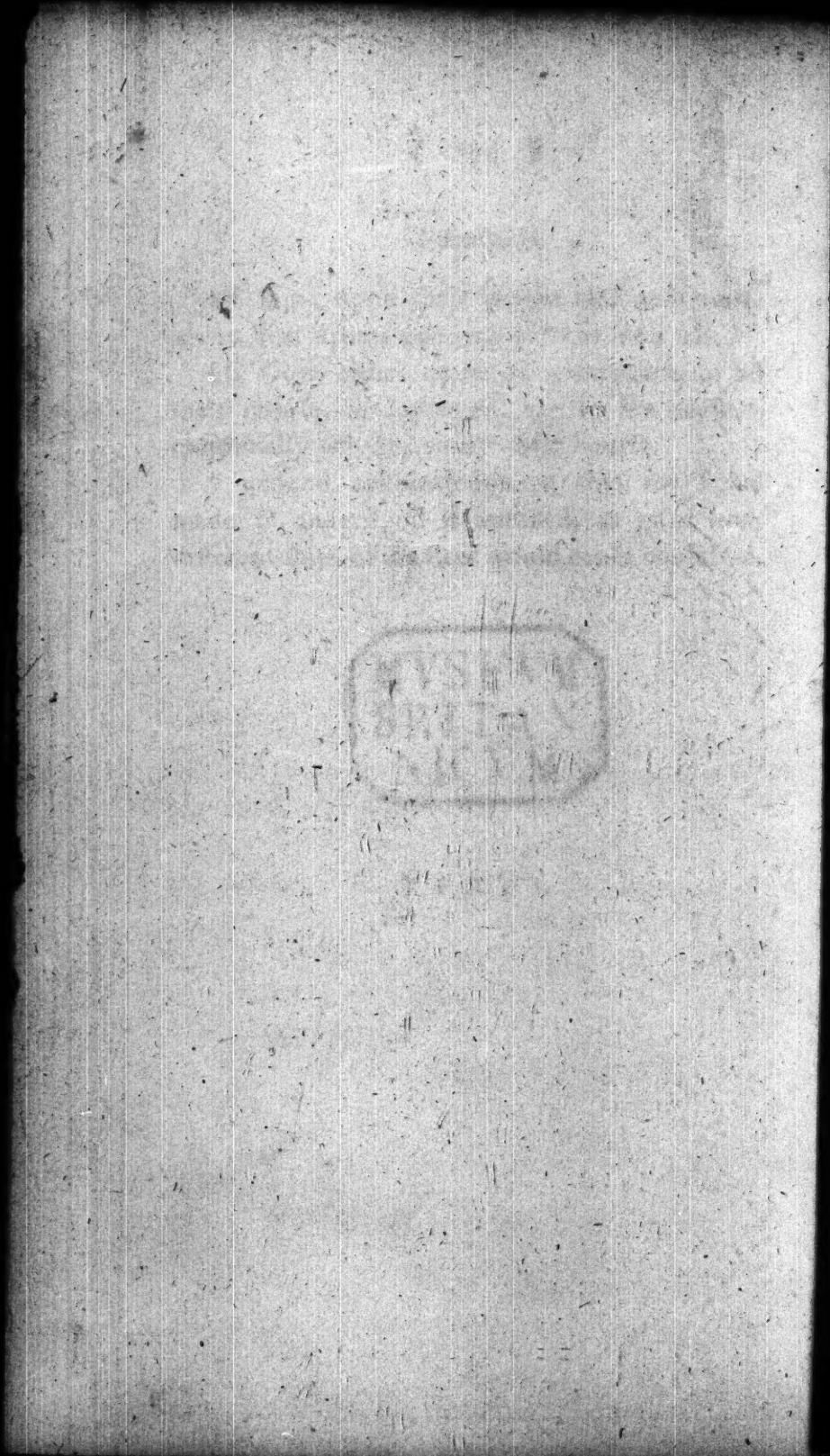
A general acknowledgment that the signal made is understood is avoided, as guns from different ships of the fleet would cause confusion.

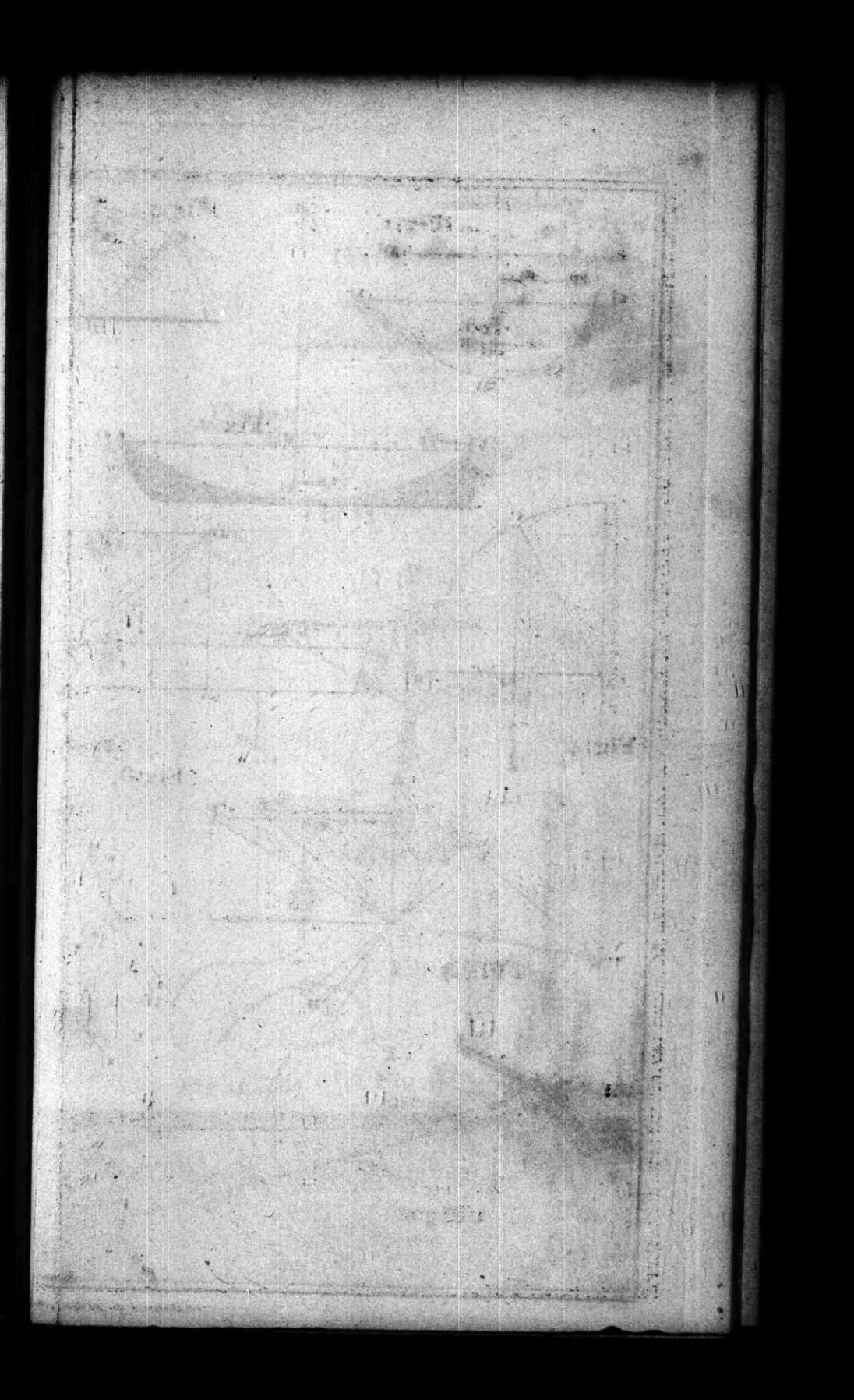


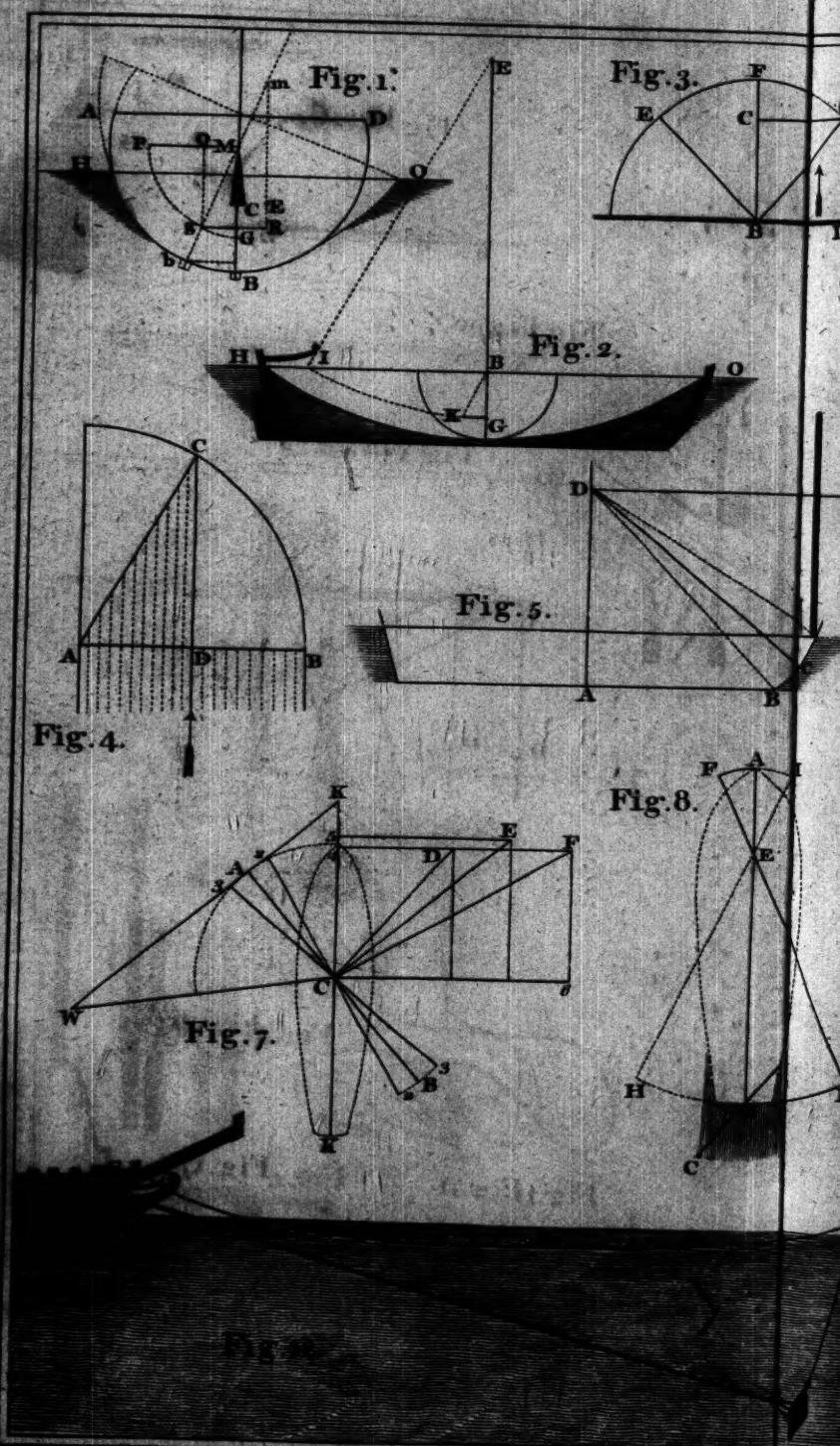
F I N I S.

of the first edition with notes and addi-  
tions by other hands were added to  
the original volume, which was  
published in 1820. The new  
volume contains a history of the  
United States from its earliest settle-  
ment to the present time, and  
is intended to supersede the former  
volume, which is now out of print.









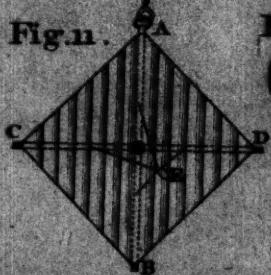
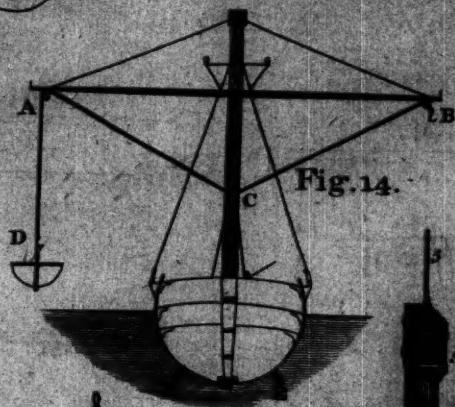
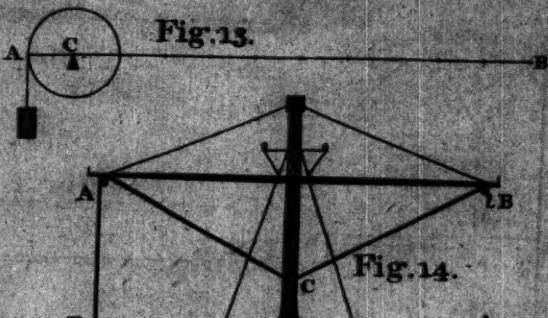
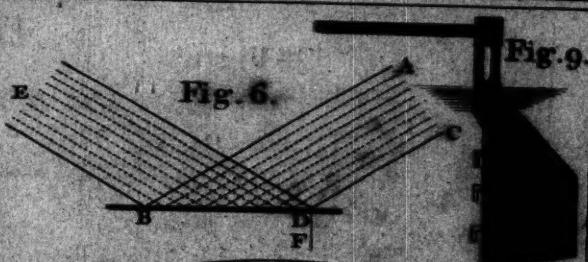
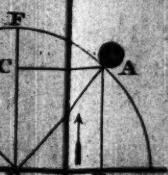
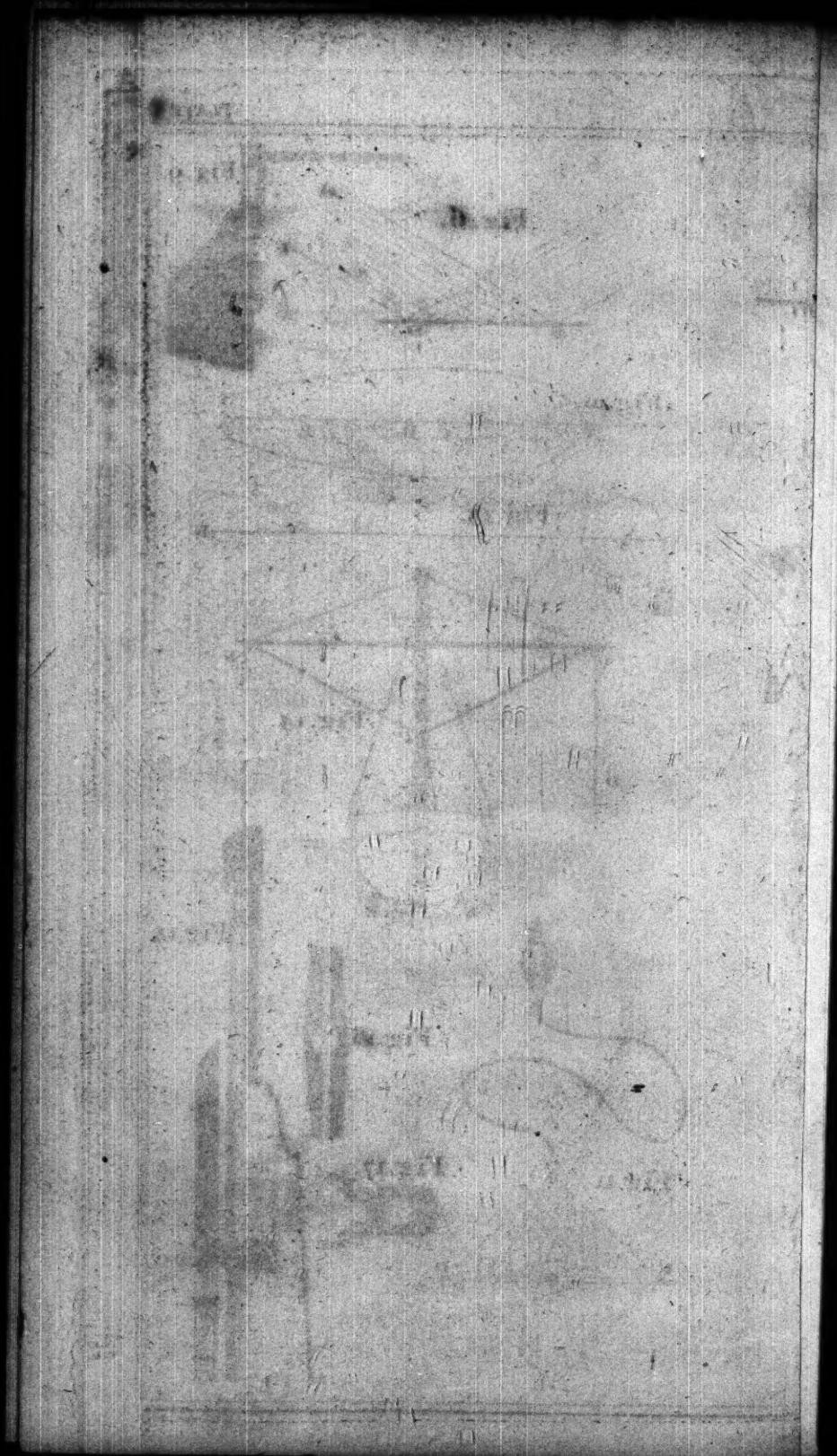


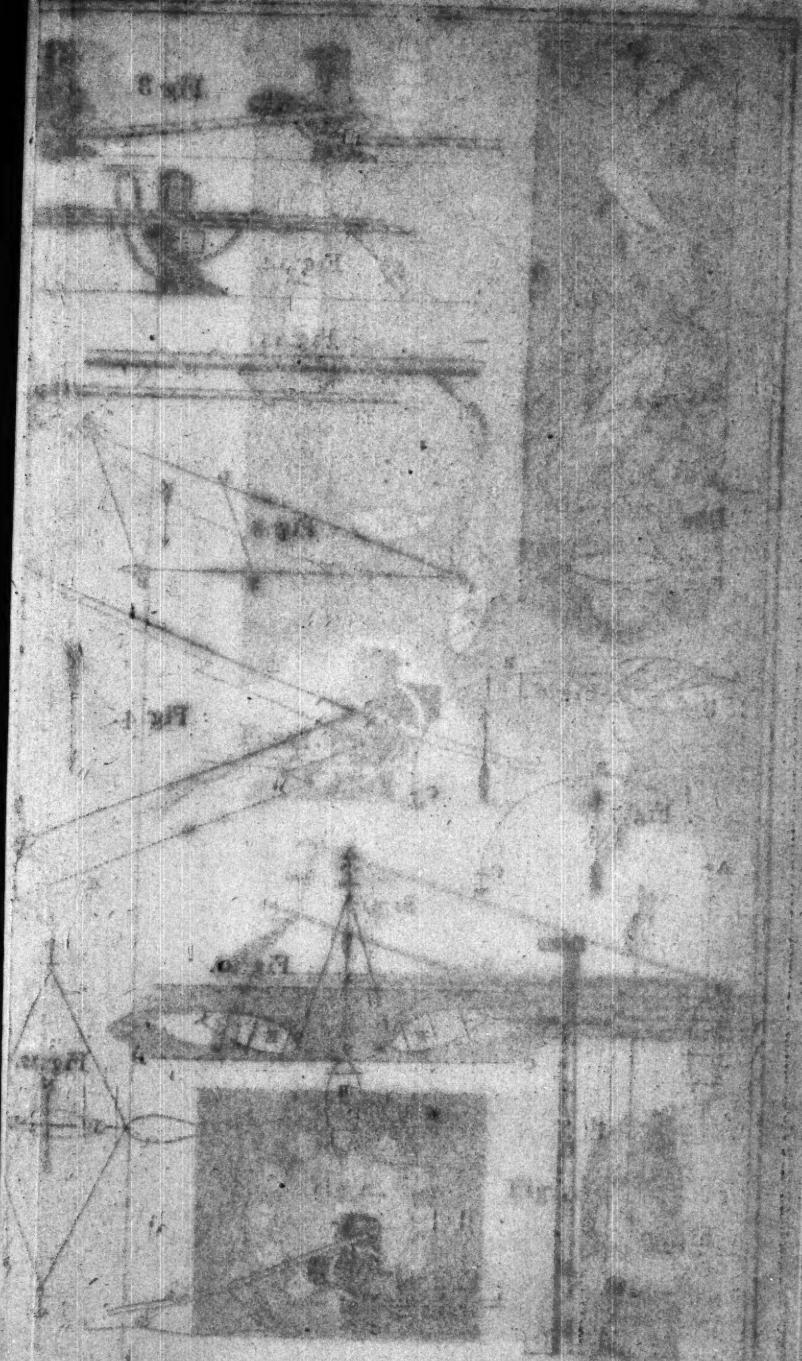
Fig. 16.

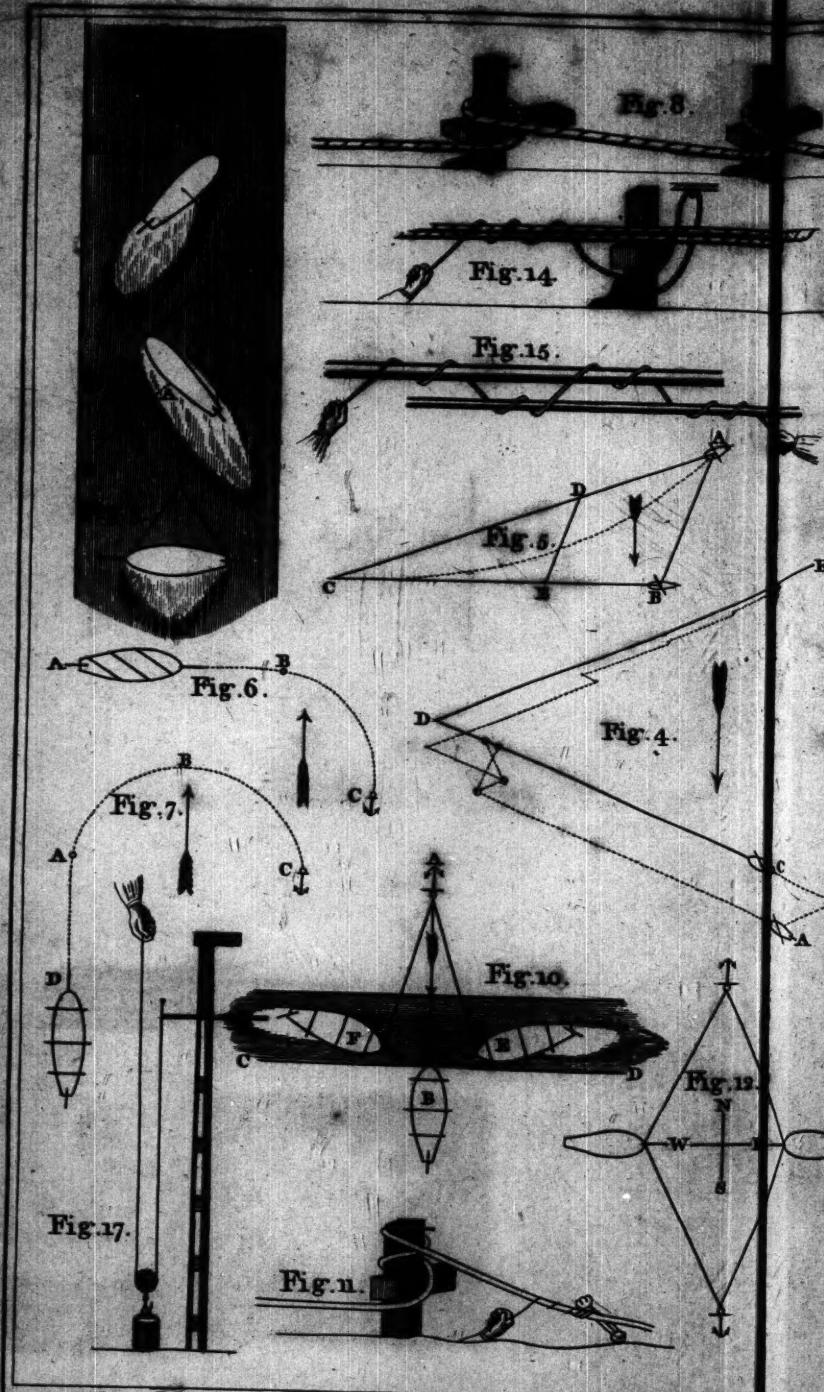
Fig. 15.

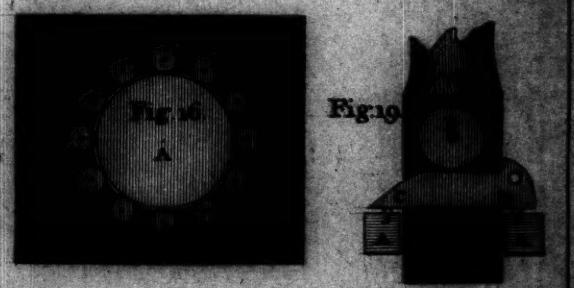
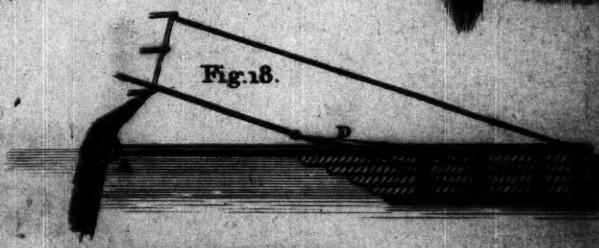
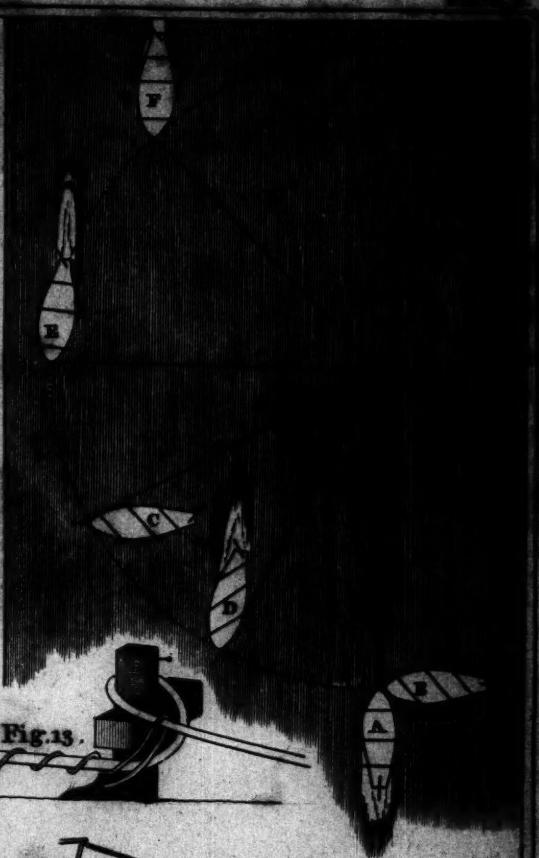
Fig. 11.

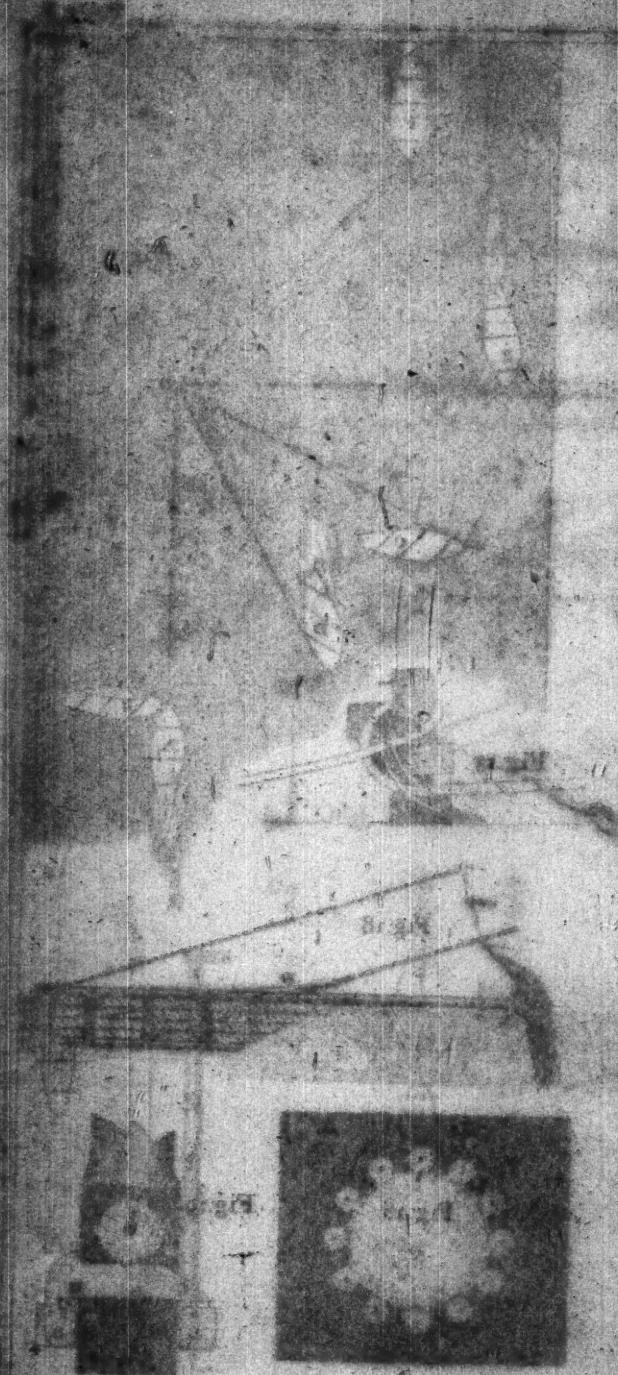
Fig. 17.

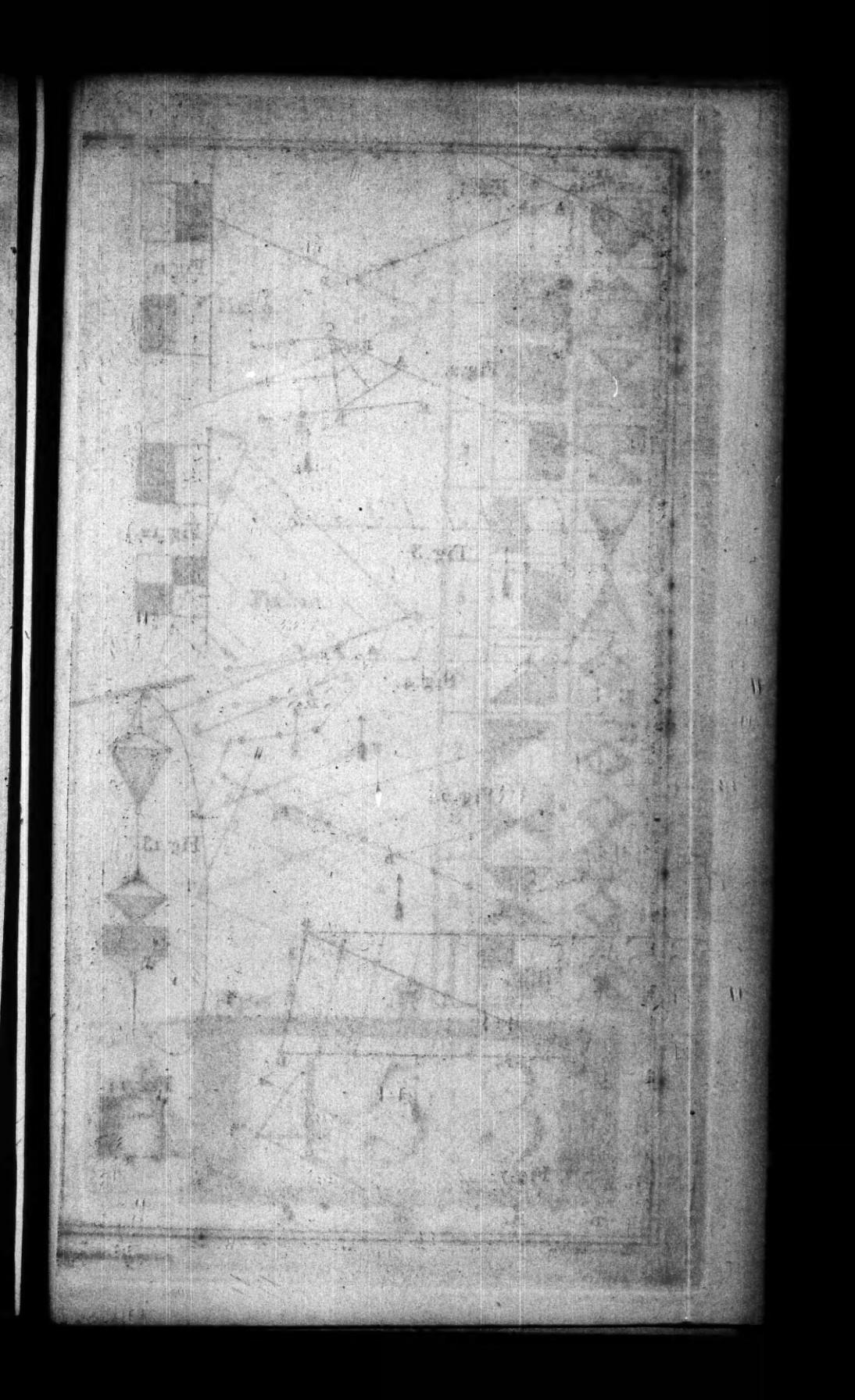












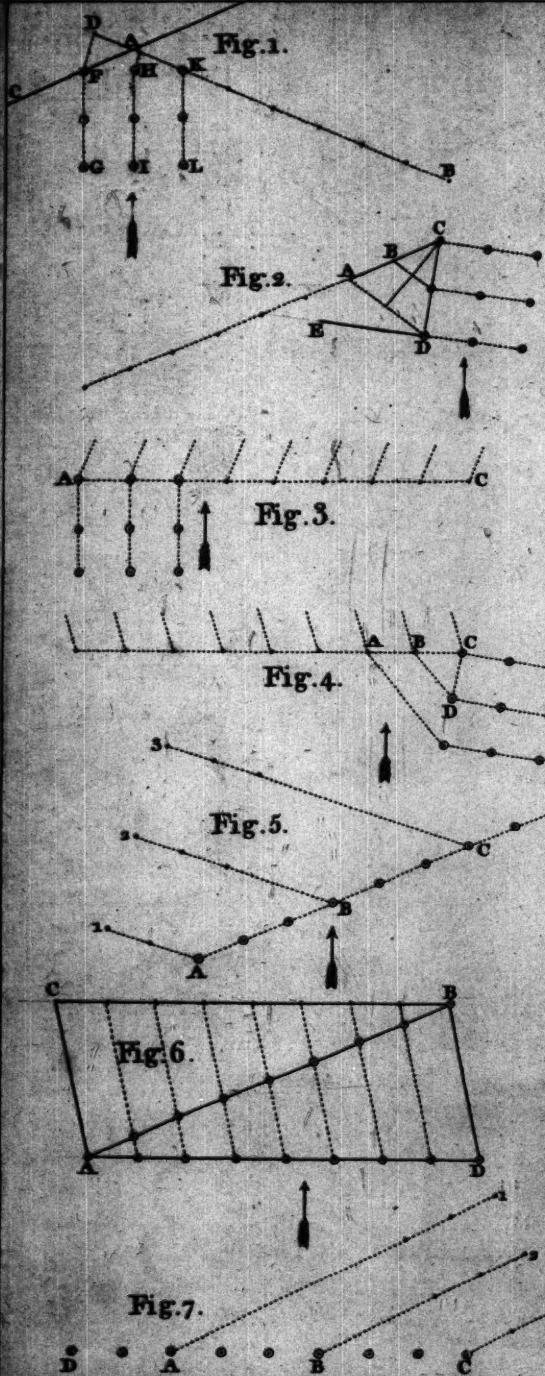


Fig. n.

Fig. 12.

Fig. 13.

Fig. 14.

Table.

	Score	Count
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Fig. 9.

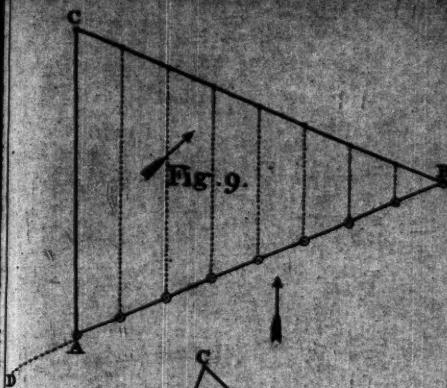


Fig. 10.

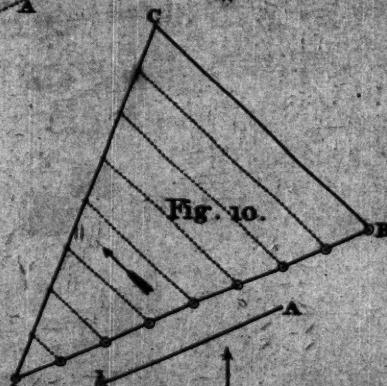


Fig. 8.

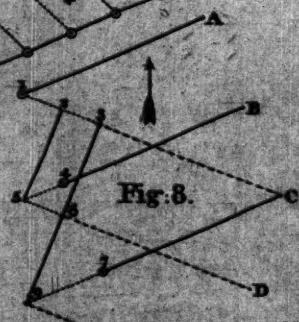
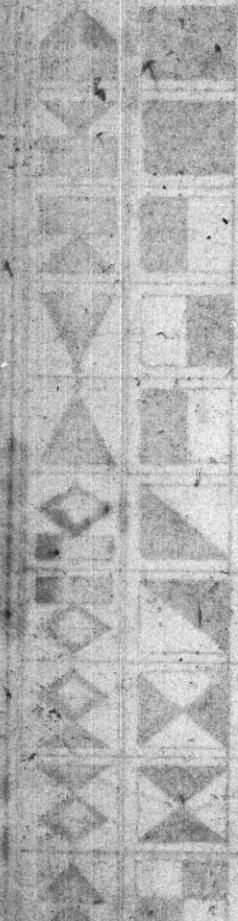


Fig. 15.



C



GAIA